Cost Benefit Study on the Use of Aluminum Versus Wooden Skids in Transporting Industrial Plant Equipment

October 1985

Mr. Angelo Barone
Operations Research and Economic Analysis Office
Headquarters, Defense Logistics Agency
Cameron Station, Alexandria, Virginia 22304-6100

BLANK PAGES
IN THIS
DOCUMENT
WERE NOT
FILMED

DEFENSE LOGISTICS AGENCY
HEADQUARTERS
CAMERON STATION
ALEXANDRIA, VIRGINIA 22314

FOREWORD

This study was requested by the Directorate of Supply Operations to find a cost effective alternative to the present practice of shipping Department of Defense owned Industrial Plant Equipment on aluminum and wooden skids. The analyses established that it may be more economical for the government to switch to an all-wood operation. Considerable savings could be realized even under current operating practices by returning to storage for reutilization those wooden skids presently discarded after one use.

ROGER C. ROY
Assistant Director
Policy and Plans

RE: Distribution Statement
Approved for Public Release. Distribution Unlimited.
Per Ms. Cleo Ridgeway, Defense Logistics Agency/LO

TABLE OF CONTENTS

		Page
Foreword		iii
Table of Contents		v
List of Tables		vii
Executive Summary		ix
I.	INTRODUCTION	1
	A. Background	1
	B. Purpose	2
	C. Scope	2
II.	METHODOLOGY	2
	A. Approach	2
	B. Assumptions	3
III.	ANALYSIS AND RESULTS	3
	A. Aluminum Skids Program	3
	1. Cost of Replacement Skid Components	4
	2. Labor and Overhead Costs	4
	3. Maintenance Facility and Materiel Costs	6
	4. Transportation Costs	6
	5. Aluminum Scrap	6
	6. Terminal Value of Aluminum Skids	6
	7. Total Operating Costs	6
	B. Wooden Skids Program	7
	1. Cost of Fabricating	7
	2. Labor Costs	9
	3. Transportation Costs	9
	4. Salvage Value of Aluminum Skids	9
	5. Total Costs	9
	6. Program Costs by Skid Size/Weight	10

C. Sensitivity Analysis..... 12

1. Cost of Wooden Skids Fabricated by Contractor (10% Profit Allowed)..... 12

2. Profit Allowance to Equalize Uniform Annual Costs..... 13

3. Cost of Wooden Skids Program if Average Unit Costs are Used..... 14

IV. CONCLUSIONS..... 15

A. Need for an Efficiency Review of DIPEC's Skidding Operations. 15

B. Need to Establish Cost Effective Wooden Skids Procurement Modes..... 15

C. Short-term Savings..... 16

V. RECOMMENDATIONS..... 16

Appendix A: DIPEC's Data..... A-1

Appendix B: Aluminum and Wooden Skid Illustrations..... B-1

Appendix C: Schedule of Personnel Costs..... C-1

Appendix D: Transportation Rates..... D-1

Appendix E: Weight Differential Transportation Costs..... E-1

Appendix F: Number of Shipments by Size and Load..... F-1

Appendix G: Format A - Aluminum and Wood Alternatives..... G-1

Appendix H: Aluminum Skids Price Lists..... H-1

Appendix J: Format A - Procurement of Wooden Skids..... J-1

Appendix K: Format A - Equal Uniform Annual Costs (UAC)..... K-1

Appendix L: Format A - Average Costs..... L-1

Appendix M: Documentation for Material Costs..... M-1

LIST OF TABLES

Number	Title	Page
1	Skids Sizes and Capacities Representative of those Occurring in IPE Shipments.....	3
2	Cost of Replacement Aluminum Skid Components by Year....	4
3	Wooden Skids Cost Estimates by Region.....	8
4	Final Cost of Wooden Skids.....	9
5	Cost Estimates of Wooden Skids by Location.....	11
6	Transportation Costs of Wooden Skids.....	11
7	Shipments by Size from Storage and Elsewhere.....	12
8	Cost of Wooden Skids Fabricated by Contractor (10% PROFIT).....	12
9	Cost of Wooden Skids Fabricated by Contractors (63% Profit).....	14
10	Cost of Wooden Skids Using Average of Unit Estimates....	15

EXECUTIVE SUMMARY

The Air Force used aluminum skids for shipment of Industrial Plant Equipment (IPE) prior to the establishment of the Defense Logistics Agency's ~~(DLA)~~ Defense Industrial Plant Equipment Center (DIPEC) in 1963. When DIPEC was established, the aluminum skid inventory was transferred to DIPEC and became the nucleus of the DIPEC skid inventory. A study conducted by DIPEC in 1974 perceived an economic advantage to the government through more extensive utilization of aluminum skids. As a result, DLAM 4215.1, Management of Defense-Owned Industrial Plant Equipment (IPE), was changed in 1975 to require use of aluminum skids in shipping IPE; in specified circumstances, such as weight of IPE exceeding 48,000 pounds, use of wooden skids was required. In 1980, another study determined that the cost to operate the program which provided 1,054 aluminum skids annually was $307,800 and that use of wooden skids to satisfy the same need would cost $460,500 annually. This was equated to an annual savings of $152,700 through the use of aluminum skids.

In 1984 DIPEC requested that administration of the aluminum skids program be automated. The 1980 study was attached in support of the automation request. Substantial technical criticism of the study, and suggestions that industry was abandoning use of aluminum skids, caused DLA's Directorate of Supply Operations to request an in-depth evaluation of DIPEC's aluminum skids program.

In the course of this study it was found that use of aluminum skids instead of wooden ones in transporting IPE within the Department of Defense is not as cost-effective as it was determined to be in the 1980 study. On the contrary, the results of the present study show that it may be more economical to switch to wooden skids operations. The uncertainty originates from large differences in the wooden skids cost estimates provided by DIPEC. As an example, a 17' x 8' wooden skid to carry a load of 40,000 lbs. costs $860.67 in Columbus, OH, and $1322.00 only 370 miles away in Mechanicsburg, PA.

Another fact set in evidence by the present study is that, under existing DIPEC operating procedures, wooden skids are seldom used for more than one shipment; increasing this reutilization rate by improving the operating procedures could result in considerable savings of government resources.

Wooden skids are currently used in about 300 shipments each year. Since wooden skids are expensive, especially in the larger sizes, the need to establish some controls on this equipment is obvious (the cost of returning a wooden skid is usually lower than that of procuring a new one). A thorough efficiency review, including value engineering studies, is needed to optimize operations and provide program managers with more reliable decision-making tools.

I. INTRODUCTION.

A. Background. When the Defense Industrial Plant Equipment Center (DIPEC) was established in 1963, ownership of an inventory of aluminum skid components was transferred to DIPEC from Warner Robins Air Force Base. DLAM 4215.1, Management of Defense-Owned Industrial Plant Equipment, provided guidance on how to requisition and use aluminum skids to the maximum extent possible when shipping items of Industrial Plant Equipment (IPE). This direction, in essence, made the use of aluminum skids a discretionary determination on the part of the shipping activity. In 1974, a study on the use of aluminum skids versus wooden skids was conducted at DIPEC. It was concluded that more extensive use of aluminum skids in shipping IPE would be to the economic advantage of the government. On 3 July 1975, DLAM 4215.1 was changed to direct DoD components to utilize aluminum skids instead of wooden skids in the shipment of all IPE except in specified circumstances.

The circumstances specified for the use of wooden skids, when skids are needed, have not changed since. Quoting from DLAM 4215.1, they are:

"...1. Equipment weighing 48,000 pounds and over.

2. Equipment, such as electronic test equipment, whose configuration, weight, or fragility require special preparation for shipment.

3. Recoverable wooden skids are available and will provide adequate protection for IPE during handling and shipment according to all requirements covered in MIL-Handbook 701.

4. Equipment presently stored on wood skids whose present condition will meet the requirements of MIL-Handbook 701.

5. Military or industrial items of IPE destined for overseas shipment.

6. International Logistics Program (formerly MAP) shipments and military assistance sales unless otherwise indicated in DIPEC shipping instructions.

7. Disposal of surplus items by donation.

8. Disposal of surplus items by sale.

9. DIPEC has notified the requesting activity that aluminum skid components are not available.

10. Circumstances and urgency of shipment justify use of wood skids..."

In Fiscal Years 1975 and 1976, additional aluminum skid components costing $205,000 were procured to establish an inventory capable of supporting the projected increase in aluminum skid utilization. The operating level of the skid inventory has not been increased since this initial purchase. Later procurements were to replace operational losses of skid components.

The 1974 study contained assumptions, estimates, and projections in areas where actual experience did not exist. The conclusions reached in that study were

considered sufficient to warrant the July 1975 change to DLAM 4215.1 making the use of aluminum skids mandatory. By 1980 DLA had several years of experience in operating the aluminum skids program under the revised criteria, and it was decided that an analysis of aluminum versus wooden skids, utilizing actual operational data, should be performed to ascertain whether or not the government was in fact realizing the projected savings in the expanded use of aluminum skids. This study determined that the cost to operate the program which provided 1,054 aluminum skids annually was $307,800 and that use of wooden skids to satisfy the same need would cost $460,500 annually. This was equated to an annual savings of $152,700 through the use of aluminum skids. By 1984 DIPEC decided to automate management of the aluminum skids program and submitted a request to this effect to DLA's Depot Operations Division; the 1980 study was attached in support of the request. Serious technical criticism of the 1980 study, and suggestions that industry was moving away from the use of aluminum skids having found them expensive to manage, convinced the Defense Logistics Agency's Directorate of Supply Operations to request an in-depth study of the program before approving the automation. As requested, this study was limited to an evaluation of the cost effectiveness of aluminum versus wooden skids, and was not intended to establish the cost effectiveness of an automated mode of management.

B. Purpose. The purpose of this study was to determine if it is more economical to ship IPE on aluminum or on wooden skids.

C. Scope. This review considered costs incurred and benefits derived by DIPEC/DLA through the use of aluminum skids, and attempts to establish what these costs and benefits would be if wooden skids were used instead of aluminum ones. Other governmental activities engaged in the skidding and shipping of IPE may also find conclusions and recommendations helpful in their operations.

II. METHODOLOGY.

A. Approach. The approach taken in this evaluation was simple and straightforward. It compared the cost incurred by the government in operating the aluminum skids program against the costs that would be incurred if IPE were shipped on wooden skids. It also compared individual aluminum versus wooden skids by size, capacity, and cost. The benefit of the program is the cost-effective skidding of some 3400 items of IPE shipped annually. From data provided in the 1980 study it was decided to divide the inventory of aluminum skids into five groups and to concentrate on skids of specific length, width, and capacity as representative of each group. The groups, and representative sizes and capacities, are presented in Table 1.

Table 1

SKIDS SIZES AND CAPACITIES REPRESENTATIVE OF THOSE OCCURRING IN IPE SHIPMENTS

SIZE	AVG LOAD CARRIED (LBS)
6' x 4'	1,000
8' x 6'	3,000
10' x 6'	8,000
14' x 8'	22,000
17' x 8'	40,000

B. Assumptions.

While every effort was made to obtain and use actual or historical data, there were some areas addressed by this study in which it would have been possible to increase our insight by devoting additional time and effort to investigation of certain aspects of this program. It was felt that the increased accuracy in projecting the program's cost-effectiveness was not justified by the much higher study-related costs involved. In these cases, sensitivity analysis was used to help the decision-maker in overcoming or avoiding uncertainty. The following assumptions were made.

1. There is an administrative and delay cost in requisitioning aluminum skid components from DIPEC, and waiting for their delivery. There is also an administrative delay cost in requesting, or contracting to manufacture, wooden skids and waiting for their delivery. For the purpose of this study these two costs were assumed equal.

2. There is a storage cost of aluminum skid components. If wooden skids were used instead of aluminum ones there would be similar storage costs for wooden skids. Therefore, these two costs were assumed equal.

3. The current inventory of aluminum skid components consists of about five million pounds of top quality aluminum. If the aluminum skid program were discontinued, this inventory would probably be used at the current rate until each component, no longer repairable or usable, would have to be sold as scrap. To simplify the analysis, sale of skids as scrap was assumed in this study.

4. The economic life of the project was established at 25 years.

III. ANALYSIS AND RESULTS.

A. Aluminum Skids Program. The cost of operating the aluminum skids program includes the procurement of replacement skid components; labor and overhead expended by DIPEC, the storage/maintenance sites and using activities; maintenance facilities and material costs; and transportation of unassembled skid packages to and from using activities. Each of these operating costs is discussed below.

1. Cost of Replacement Skid Components. The annual cost of replacing aluminum skids components is established through historical records provided by DIPEC in Appendix A. Procurement of skid components in FY 75 and FY 76 are considered, as in the 1980 study, investment costs to build an inventory with which to operate the program. For this reason they are not included in estimating program operating costs. Two types of aluminum skids are now in inventory: Tumtane Company (TUMCO) and Harvey (See illustrations in Appendix B). While aluminum skids components are reusable, they are lost to the operating inventory for a variety of reasons, such as wear, damage, loss, and placement in long term storage under an item of IPE. Whatever the reason for the loss, if the components are not in the inventory and available for reutilization, they must be replaced through procurement of new components.

Procurement costs of replacement aluminum components by year were found as listed in Table 2:

Table 2

COST OF REPLACEMENT ALUMINUM SKID COMPONENTS BY YEAR

FY	AMOUNT
77	$ 30,134
78	$ 63,494
79	$ 15,260
80	$ 68,494
81	$160,180
82	$ 58,450
83	$119,232
84	$207,413

A linear regression analysis of these data shows that replacement components' costs are increasing at an annual rate of about $21,000. In FY 86 these costs are expected to be about $208,000. This value was used in this analysis as the annual cost of replacement components.

2. Labor and Overhead Costs. Labor at DIPEC includes two GS-4 Clerks who work full time on the aluminum skid program and a YW-3506-00 part time student aid who works 50% of the time on the program. No overhead positions would be eliminated by phasing out the aluminum skids program. Therefore, costs for ADP support, finance and accounting support, supervision, etc., were not included in the computations. The approximate cost of DIPEC's direct labor is (see Appendix C):

GS-4, Clerk (2)	$43,801
GS-2, Student Aid (1/2)	$ 2,202
	$46,003

Aluminum skid components are received, stored, repaired, and issued at Defense Construction Supply Center (DCSC), Columbus, Ohio, and at Defense Depot Tracy (DDTC), Stockton, California. These two activities are designated as aluminum skids primary storage sites. Secondary storage sites, where little or no repair of aluminum skids is performed, are at Mechanicsburg, Pennsylvania,

Seneca Army Depot, Seneca, New York, and at DIPEF, Atchison, Kansas. The management and maintenance of aluminum skids require the services of a variety of employees, including warehousemen, material handling equipment (MHE) operators, mechanics, etc. The composite approximate direct labor cost incurred by DCSC, DDTC and the secondary storage sites is $240,681 annually. (See Appendix C for backup computations.)

Activities using aluminum skids also incur labor costs that would not be incurred if wooden skids were used. These include the cost to the shipping activity in assembling a skid from a package of components furnished by DIPEC, and the cost to the receiving activity in disassembling a skid and preparing the components for return to DCSC or DDTC. In the 1980 study it was estimated that it takes approximately 1.5 hours to assemble a skid with 4 runners, 2 headers, 2 tie bars, and 4 mounting plates, with anywhere from 72 to 128 sets of nuts, bolts, lock and flat washers for TUMCO skids. It was estimated that disassembly and preparation for return requires a like amount of time. However, the data collected for this study made the 1980 estimate suspect. DLA's Depot Operations Division has established through inquiries with DIPEC and Defense Reutilization and Marketing Service that it takes an average worker a total of at least 2.5 hours for assembly (or disassembly) operations, and to prepare the skids and paperwork for shipment. This additional labor cost also applies to items shipped and received by DCSC and DDTC. The labor cost ($240,681) for these two activities applies only to the management of skid components and does not include shipment or receipt of skidded items. The skill level required for assembly/disassembly of an aluminum skid, at least at the storage sites, has been determined to be WG-6 or more. Hourly pay rates for Wage Grade employees vary by locality. In this study it was decided to use a rate prevailing in more industrialized areas such as the East or West Coast since the majority of the shipments are in these areas. As of 26 March 85 the hourly rate for a WG-6 in New York, New York, was $10.50; as of 16 April 85 it was $10.54 in Stockton, California. The latter pay rate was used in computations here. The direct labor cost for assembly/disassembly of aluminum skids, therefore, consists of (see p. A-15 for total shipments in each category):

a. Shipments of IPE from user to storage (disassemble package and assemble skid under IPE: 2.5 hours):

$10.54 x 2.5 hours x 1645 skids x 1.18 leave factor x 1.362 benefits = $69,664

b. Shipments of IPE from user to repair facility of IPE and back to user (user assembles skid sent by DIPEC under IPE then disassembles skid to return to storage site 2.5 x 2 = 5 hours):

$10.54 x 5 hours x 98 skids x 1.18 x 1.362 = $8,300

c. Shipments of IPE from user 1 to user 2 (User 1 assembles skid sent by DIPEC under an item of IPE, User 2 disassembles skid and returns to DIPEC: 2.5 x 2 = 5 hours):

$10.54 x 5 hours x 731 skids x 1.18 x 1.362 = $61,914

d. Shipments of IPE from storage to user (IPE is stored on skids; user removes skids from under IPE and returns it to DIPEC: 2.5 hours):

$10.54 x 2.5 hours x 903 skids x 1.18 x 1.362 = $38,241

e. Total assembly and disassembly labor costs $178,119.

The Total Annual Program Labor Cost is therefore:

$ 46,003	DIPEC Direct
$240,681	Storage/Maintenance Direct
$178,119	User Direct
$464,803	Total Direct

3. Maintenance Facility and Material Costs. The DLA operates Allocable Industrial Plant Equipment (IPE) maintenance and repair shops at DCSC and DDTC, the two primary storage and repair sites for aluminum skid components. Repair of aluminum skid components usually consists of straightening bent components, or cutting off, beveling, and welding damaged components to make a serviceable shorter component. While the storage and repair of aluminum skid components represents only a small percentage of the IPE operations at DCSC and DDTC, they do require some storage space, shop space, equipment (i.e., welders, saws, presses), and operating supplies (i.e., welding rods, saw blades, sanding/grinding wheels). From Appendix M the approximate annual expenditure at DCSC and DDTC for supplies is $4000. Because storage facilities would also be used for wooden skids, facilities costs are not considered in this analysis. Also, the equipment used is drawn from the General Reserve, and its costs were excluded as minimal.

4. Transportation Costs. Transportation cost for the shipment of aluminum skid components includes shipment of components, or packages, from primary and secondary storage sites to field activities preparing IPE for shipment. It also includes the return shipment of components, or packages, from point of last use to central storage at DCSC and DDTC. It does not include the difference in transportation cost for shipment of an item mounted on a wooden skid versus an item mounted on an aluminum skid. This difference is addressed elsewhere in this study. Transportation fund blotter records maintained by DIPEC personnel administering the aluminum skid program reveal FY 1984 expenditure of $92,300 for transporting skid components to and from using and receiving activities (see p A-14). This figure was used as an estimate of annual transportation costs.

There is a difference in weight between aluminum and wooden skids. Generally, wooden skids weigh more. However, in the 6' X 4' skid size, to carry a 1000 lbs load, aluminum skids are 82 lbs heavier then wooden ones. The applicable transportation rate (see Appendix D) is $.1208 per pound. The Weight Differential Transportation cost is computed in Appendix E and is $6,023.

5. Aluminum Scrap. Represents expected return to the Government of aluminum parts sent to disposal annually. (See p. A-28)

6. Terminal Value of Aluminum Skids. At the end of the economic life 4,568,750 pounds of aluminum (see p. A-17) will be sold as scrap at $.50 per pound.

7. Total Operating Costs. The total annual operating cost of the aluminum skid program (not including costs common to both the aluminum and wooden skid programs) at its present volume was computed as $773,126. A summary of the contributing cost factors is listed below:

a. Non-Recurring Costs: Equipment to repair aluminum skids is obtained through General Reserve assets and is already in place. Switching to a wooden skid operation would require increased use of wood-working equipment (also already in place) thus eliminating any cost savings achieved by stopping use of metal working equipment. Therefore, non-recurring costs are not included.

b. Recurring Costs are summarized below:

(1)	Labor:	(a) DIPEC Direct	$ 46,003	
		(b) Storage/Maintenance Direct	$240,681	
		(c) User Direct	$178,119	
			$464,803	$464,803
(2)	Overhead: Assumed to be a cost common to both alternatives.			
(3)	Facilities: Assumed to be a cost common to both alternatives.			
(4)	Material			$ 4,000
(5)	Transportation Costs (shipments of aluminum skids to users and back to storage)			$ 92,300
(6)	Replacement of Components Cost			$208,000
(7)	Weight Differential Transportation Cost			$ 6,023
				$775,126
(8)	Aluminum Scrap: 4011 lbs X $.50/lb. =			2,000
	Total Recurring Costs			$773,126

c. Terminal Value of Aluminum Skids:

At the end of the economic life the skids will have a terminal value of 4,568,750 lbs X .50/lb = $2,284,375

B. Wooden Skids Program. The cost of using wooden skids in lieu of aluminum skids includes the cost of acquiring or fabricating equivalent wooden skids and the additional transportation cost incurred in shipping skidded IPE resulting from the greater weight of wooden skids in the "larger" sizes.

1. Cost of Fabricating. The cost of fabricating a wooden skid is influenced by several variables. These include, but are not necessarily limited to, prevailing labor rates in the area where the skid is fabricated, availability and cost of acceptable lumber and hardware, whether the skid is fabricated in house by a government activity or contracted out to a commercial rigger. For these reasons, cost estimates were requested from different sources. The estimates furnished and their sources are listed in Appendix A. These estimates are presented in Table 3.

WOODEN SKIDS COST ESTIMATES BY REGION

Size	Load in Lbs.	DCSC	DDMP	Atchison
6'x 4'	1,000	$120.85	$244.80	$187.45
8'x 6'	3,000	$137.48	$279.40	$366.15
10'x 6'	8,000	$158.61	$466.50	$405.36
14'x 8'	22,000	$460.00	$989.00	$786.18
17'x 8'	40,000	$860.67	$1,322.00	$1,093.53

Since wooden skids are usually fabricated in-house (Appendix A), the cost estimates provided by the DCSC were used in this analysis for the following reasons:

a. Columbus is centrally located.

b. If costs as high as DDMP's were prevalent in other parts of the country DIPEC should have the skids fabricated in the Columbus area and transported where needed, or export DCSC's operating procedures to other locations. A sensitivity analysis on the cost to fabricate is performed in Section C.

As stated in Section IIA, five different sizes and load capacities were identified as representative of the skids used in the shipment of IPE within DoD in the continental US. The cost of wooden skids of the same size and capacity is used to project the total program cost for wood. Under current DIPEC operating procedures wooden skids are generally considered to be for a single shipment only. In Appendix A (p. A-18) it is suggested that the reuse factor of wooden skids is at most 1.25. From p. A-15 we can compute a minimum reuse factor: For the 1645 average number of shipments from user to storage, and for the 98 shipments from user to repair facility and back to user, the reuse factor would be at least 2. It follows that currently the reutilization factor is given by the weighted average:

$$\frac{(1645 + 98)\ 2 + (731 + 903)}{3377} = 1.5161$$

This means that for each 100 skids fabricated at least 152 shipments are realized, making the skidding for each shipment cost 100/152 or 65.79% of the initial cost of a wooden skid.

The cost of wooden skids is therefore displayed in Table 4.

Table 4

FINAL COST OF WOODEN SKIDS

Size	Initial Cost	Reuse Factor	Final Cost	Total of Avg Shipments	% of Shipment By Size	No. of Ship by Size	Estimate Total Cost
6'x 4'	$120.85	.6579	$ 79.51	3377	.18	608	$ 48,342
8'x 6'	$137.48	.6579	$ 90.45	3377	.22	743	$ 67,204
10'x 6'	$158.61	.6579	$104.35	3377	.27	912	$ 95,167
14'x 8'	$460.00	.6579	$302.63	3377	.24	810	$245,130
17'x 8'	$860.67	.6579	$566.23	3377	.09	304	$172,134
							$627,977

2. Labor Costs. The wooden skids cost estimates provided include labor and material costs.

3. Transportation Costs. Under present operating procedures wood skids are not being transported where needed. Used skids are reutilized only if locally available. However, in the "larger" sizes wooden skids weigh more than aluminum ones. This difference in weight translates into higher transportation costs when shipping IPE on wooden skids. The weight differential transportation costs for wooden skids, computed in Appendix E, amount to $66,945.

4. Salvage Value of Aluminum Skids. By switching to an all-wooden operation, aluminum skids currently in inventory would become replaced assets, and their value must be deducted from the total discounted costs for this alternative. We assumed that aluminum skids would be scrapped. The salvage value was $.50 per pound. The aluminum skids inventory was estimated to weigh 4,568,750 pounds.

5. Total Costs. A summary of the cost of wood skids (not including costs common to both aluminum and wood programs) to perform the same functions as aluminum skids used by DLA activities is shown below:

a. Non-Recurring Costs: Equipment to fabricate wooden skids is already in place because wooden skids are being used to ship items of IPE weighing more than 48,000 lbs., and in some other instances. Therefore, non-recurring costs are not included.

b. Recurring Costs:

(1)	Annual cost of fabricating wooden skids	$627,977
(2)	Weight differential transportation costs	$ 66,945
		$694,922

c. Salvage Value of Aluminum from replaced assets:

Year 0 : 4,568,750 lbs. X $.50/lb = $2,284,375

This comparison of program costs includes funds actually being expended in the operation of the aluminum skid program as opposed to funds that would be required to provide the same result utilizing wooden skids. Monetary values cited do not include cost items common to both the aluminum and wood programs. The results of the analysis show that the annual cost of operating the aluminum skid program at its present level is $773,126. The annual cost to provide the same capability in fabricated wooden skids is $694,922.

Aluminum skids are assembled from, and disassembled into, basic components which are repaired or replaced as they become damaged; once a damaged component is repaired, for all practical purposes it is new. It follows that physical life is not a limiting factor for economic life, and neither is technological life. The appropriate time period over which to conduct the economic analysis becomes then the mission life. Since we can anticipate a continuing need for skids to transport IPE within the DoD, we can take the economic life to be any number of years. As recommended in DLAM 7041.1, Economic Analysis, for cases such as this we use an economic life of 25 years.

Assuming a 25 year project life and salvage of aluminum skids components as scrap, a Format A economic analysis is presented in Appendix G. The economic analysis computations in Appendix G show that for the next 25 years the Uniform Annual Cost of skidding IPE will be $749,859 using aluminum skids, and $455,059 using wooden skids.

6. Program Costs by Skid Size/Weight. In addition to comparing the total program cost of wooden versus aluminum skids, a comparison of individual skids of various size and weight ranges is necessary to determine if there is a point at which the economic advantage changes from wooden to aluminum. Since the aluminum skids used include a large number of different sizes and weight ranges, no attempt is made to compare each aluminum skid utilized to an equivalent wooden skid, but rather the representative sample of five skid sizes at various load ranges is used for comparative purposes.

Table 5 below compares costs for representative sizes of aluminum and wooden skids.

Wooden skids costs were provided on pp. A-24 to A-27, while aluminum skids costs were computed from the specifications on pp. A-19 to A-23 and the Aluminum Skids Price List (Appendix H) provided by DIPEC at the time of the original data submission.

Aluminum skids totals do not include costs of the 78 to 128 sets of nuts, bolts, and washers required to assemble the skids. Nor does it include the labor cost of 2.5 hours to assemble the skids from the components. Also, the costs listed are for the less expensive TUMCO skids.

Table 5

COST ESTIMATES OF WOODEN SKIDS BY LOCATION

SIZE	COST* ESTIMATE OF AL-SKIDS	COST OF WOOD SKIDS			AVG COST	WOOD SKID WEIGHT	ALUMINUM SKID WEIGHT
		DCSC	DDMP	ATCHISON			
6′ x 4′	$310.1	$120.85	$244.80	$187.45	$184.36	113	195
8′ x 6′	$412.1	$137.48	$279.40	$366.15	$251.01	392	255
10′ x 6′	$502.9	$158.61	$466.50	$405.36	$343.49	648	292
14′ x 8′	$702.6	$460.00	$989.00	$786.18	$745.06	1437	421
17′ x 8′	$1064.6	$860.67	$1322.00	$1093.53	$1092.09	2454	648

*For TUMCO skids, not including "hardware:" nuts, bolts, washers.

The table shows that wooden skids cost estimates provided by DCSC are lower at all sizes and loads than the corresponding aluminum skids costs. The rates in Appendix D allow estimation of transportation costs of wooden skids by size as shown in Table 6.

Table 6

TRANSPORTATION COSTS OF WOODEN SKIDS

Size	Wt	Rate	Transport Cost/Skid	Round Trip	Total Cost of DCSC Skid & Round Trip Transportation
6′ x 4′	113	$.1208	$ 13.65	$ 27.30	$ 148.15
8′ x 6′	392	$.1208	$ 47.35	$ 94.71	$ 234.89
10′ x 6′	648	$.1208	$ 78.28	$156.56	$ 315.17
14′ x 8′	1437	$.1208	$173.58	$347.17	$ 807.17
17′ x 8′	2454	$.0914	$224.30	$448.59	$1309.26

Table 6 shows that even if we were to add round trip transportation costs to DCSC's totals for wooden skids, aluminum skids prices would still be higher for sizes smaller than 10′ x 6′ to carry loads below 10,000 lbs.

In addition, considerable savings could be achieved by managing wooden skids more intensively. Specifically, more intensive management would entail: (1) a complete revision of operating procedures. For example, could the user of IPE be assigned responsibility for storage of wooden skids, until needed again, at no cost to the government? What would be the cost of requiring truckers to carry skids back with them after delivery of IPE? It may be necessary to establish general procedures for case management. (2) Conduct value engineering (VE) studies to determine the best skid design for the specified operating conditions. This VE study should include type of wood to use, binders (should nails, screws, bolts, or plugs and glue be used?), repair procedures (should a component with too many holes be replaced, or just "plugged" with wood and glue or plastic wood?)

C. Sensitivity Analysis. In the analysis above, we estimated the cost of replacing aluminum skids used every year with wooden skids which were assumed to be fabricated in-house. However, many shipments originate from locations where wooden skids must be procured competitively from private contractors. Thus it is possible that skids may cost more.

1. Cost of Wooden Skids Fabricated by Contractor (10% Profit Allowed). To estimate costs for this eventuality, a 10% profit is added to the estimates provided by DCSC, to all shipments of IPE not originating from storage. It is felt that 10% is a fair estimate of the rate of return on investment sought by contractors under competitive circumstances.

a. Fabrication Costs. The number of shipments of IPE on aluminum skids other than from storage to user are (see p. A-15): 1645 + 98 + 731 = 2474.

Using the percentages of various sizes in the inventory (see p. A-16) these shipments could be apportioned to the representative sizes as shown in Table 7 below.

Table 7

SHIPMENTS BY SIZE FROM STORAGE AND ELSEWHERE

(1) SIZE	(2) %	(3) SHIPMENTS NOT FROM STORAGE	(4) TOTAL SHIPMENTS	(5) DIFFERENCE
6′ x 4′	.18	445	608	163
8′ x 6′	.22	544	743	199
10′ x 6′	.27	668	912	244
14′ x 8′	.24	594	810	216
17′ x 8′	.09	223	304	81
Totals		2474	3377	903

The cost of wooden skids may then be calculated as in Table 8.

Table 8

COST OF WOODEN SKIDS FABRICATED BY CONTRACTOR (10% PROFIT)

(1) SIZE	(2) UNIT COST (IN HOUSE)	(3) UNIT COST (CONTRACTOR)	(4) TOTAL COST (CONTRACTOR)	(5) TOTAL COST (IN-HOUSE)
6′ x 4′	$ 79.51	$ 87.46	$ 38,919.70	$ 12,960.13
8′ x 6′	$ 90.45	$ 99.50	$ 54,128.00	$ 17,999.55
10′ x 6′	$104.35	$114.79	$ 76,679.72	$ 25,461.40
14′ x 8′	$302.63	$332.89	$197,712.90	$ 65,368.08
17′ x 8′	$566.23	$622.85	$138,895.55	$ 45,864.63
			$506,336.	$167,654.

In column 2 of Table 8 are the costs of wooden skids reduced by application of the reuse factor (computed in Table 4). Each entry in column 3 equals column 2 plus 10% profit. Entries in columns 4 and 5 are obtained by multiplying corresponding numbers from column 3 Table 8 by column 3 Table 7, and column 2 Table 8 by colunm 5 Table 7, respectively.

b. Total Costs. The total cost of wooden skids procurement with consideration of some contractor fabrication is then $673,990.

A summary of costs for this case follows:

(1) Non-Recurring Costs: -0-

(2) Recurring Costs:

(a) Cost of Wooden Skids :

Fabricated by contractor	$167,654	
Fabricated in house	$506,336	
	$673,990	$673,990

(b) Weight differential transportation cost $66,945

$740,935

(3) Salvage value of aluminum. Aluminum skids now in inventory are considered as replaced assets. Their sale as scrap would yield:

Year 0: 4,568,750 lbs x $.50/lb = $2,284,375

The Format A analysis is in Appendix J; the results for wooden skids still compare favorably with the aluminum skid alternative:

	Uniform Annual Cost (UAC)	UAC After Inclusion of Existing Assets Replaced and Terminal Value
Aluminum	$773,126	$749,855
Wood	$740,935	$501,072

2. Profit Allowance to Equalize Uniform Annual Costs.

A 63% profit margin must be allowed to contractors of wooden skids not fabricated in-house before the Uniform Annual Cost of aluminum skids becomes about the same as that of wooden skids over a 25-year economic life (Appendix K).

Under a 63% profit margin condition, the cost of procuring skids is calculated in Table 9.

Table 9

COST OF WOODEN SKIDS FABRICATED BY CONTRACTORS (63% PROFIT)

SIZE	UNIT COST (IN-HOUSE)	UNIT COST (CONTRACTOR	TOTAL COST (CONTRACTOR)	TOTAL COST (IN-HOUSE)
6' x 4'	$ 79.51	129.60	$ 57,672.58	$12,960.13
8' x 6'	$ 90.45	147.43	$ 80,203.82	$17,999.55
10' x 6'	$104.35	170.09	$113,620.45	$25,461.40
14' x 8'	$302.63	493.29	$293,012.42	$65,368.08
17' x 8'	$566.23	922.95	$205,818.94	$45,864.63
		Subtotals	$750,328.22	$167,653.79
			Total	$917,982.01

Total	$917,982.01
Weight Differential Transportation Costs	$ 66,945.
	$984,757
Existing Assets Replaced (Salvage value of aluminum skids)	$2,284,375

A comparison of Uniform Annual Costs follows:

	Uniform Annual Cost	Uniform Annual Costs with Existing Assets Replaced and Terminal Value
Aluminum	$773,126	$749,855
Wood	$984,757	$744,895

3. Cost of Wooden Skids Program if Average Unit Costs are Used.

In Section B6 an average of all wooden skids cost estimates provided by DIPEC was calculated for each representative size. These averages will be used next to see what effect they have on the wood skid alternative.

In Table 10, for each skid size we list: The average cost (AC), AC reduced to 65.79% of original value after application of a reuse factor of 1.52, the number of skids to be shipped, total cost:

Table 10

COST OF WOODEN SKIDS USING AVERAGE OF UNIT ESTIMATES

Size	Avg Cost	Average Cost After Reuse Reduction	Number	Cost
6′ x 4′	$ 184.36	$121.29	608	$ 73,744
8′ x 6′	$ 251.01	$165.14	743	$165,139
10′ x 6′	$ 343.49	$225.98	912	$206,095
14′ x 8′	$ 745.06	$490.17	810	$397,041
17′ x 8′	$1092.09	$718.49	304	$218,420
Total				$1,060,439

Total	$1,060,439
Weight Differential Transportation Costs	$ 66,945
	$1,127,384
Existing Assets Replaced: salvage value of aluminum skids as scrap	$2,284,375

Results of a Format A analysis (Appendix L) are compared below to those for the aluminum skids alternative.

	Uniform Annual Cost (UAC)	UAC after Inclusion of Existing Assets Replaced and Terminal Value
Aluminum	$ 773,126	$749,855
Wood	$1,127,384	$887,522

Uniform Annual Costs for an all-wood operation are now higher than those generated by the aluminum skids program.

IV. CONCLUSIONS.

This study revealed several interesting findings:

A. Need for an Efficiency Review of DIPEC's Skidding Operations. Under current operating policies and procedures, over 300 items of IPE are shipped annually on wooden skids. Wooden skids are not normally used for more than one shipment. The analysis showed that slight increases in there utilization rate of wooden skids will result in considerable savings of government resources whether or not a decision is taken to switch to an all-wood operation. As the analysis progressed, it became clear that an exhaustive efficiency review of existing practices in handling wooden skids is necessary. Such a review could result in restructuring the whole skidding program, and provide managers with effective decision-making tools. Some suggestions are made for review items and approaches.

B. Need to Establish Cost Effective Wooden Skids Procurement Modes. DIPEC provided wooden skids costs from three different sources. The cost variation from one source to the other is so large that serious consideration

should be given to fabricating wooden skids in one location for transportation to other areas. As an example: A 17' x 8' skid to carry 40,000 lbs costs the Government $1322 in Mechanicsburg, PA, and $860 in Columbus, OH; since there are only 367 miles between the two locations, the transportation idea is not far fetched. Even better, provide other locations with information on DCSC's skid-making techniques. The uncertainty about the cost of wood skids made it necessary to perform extensive sensitivity analysis. The uniform annual costs for the two alternatives became about the same only when hypothetical contractors were allowed a profit margin of over 60% in providing wooden skids to the Government. If wooden skids cost estimates provided by DCSC are as reliable as believed, switching to an all-wood operation is in the best interest of the government.

C. Short-term Savings. As specified in paragraph I, wooden skids must be used under certain circumstances. Once the funds are expended it may be cost-effective to return the wooden skids. A simple decision-making tool could compare major return costs (such as transportation, repairs to existing damage, and storage, if any) to the costs of procuring new skids (fabricated in-house or by contractor).

V. RECOMMENDATIONS.

A. It is recommended that DIPEC establish, as soon as possible, reliable wooden skids fabrication and transportation costs. These data are necessary to fill a simple return decision-making tool to be devised locally or by this office.

B. The analysis has shown that an all-wood operation could result in savings of Government resources. The savings could be maximized by improvements in existing operating procedures. It is recommended that an efficiency review of DIPEC's IPE skidding operations be conducted to increase wooden skids reutilization rates. The assistance of procurement, legal, and transportation experts may be required. The study should include value engineering analyses of wooden skids design and specifications to adapt them to the operating procedures established by the review. Time and motion studies of wooden skid construction could improve operations at some depots and provide managers with valuable decision making tools.

C. It is also recommended that after completion of the efficiency review, or as part of it, this economic analysis be repeated to establish a baseline for future program evaluations.

Appendix A

DIPEC's Data

Appendix A

DIPEC's Data

DEFENSE LOGISTICS AGENCY
DEFENSE INDUSTRIAL PLANT EQUIPMENT CENTER
MEMPHIS, TENNESSEE 38114

IN REPLY
REFER TO DIPEC-D

3 APR 1985

SUBJECT: Data Request for Cost Benefit Study on the Use of Aluminum Skids Versus Wood Skids In Transporting Industrial Plant Equipment (IPE) Within the DoD

TO: DLA-LR
Attn: Mr. A. Barone

1. References:

a. DLA-OW letter, 21 Sep 84, subject as above.

b. DIPEC-L letter, 14 Nov 84, subject: DLA Aluminum Skid Study (furnished data provided by Seneca for personnel expenses).

2. The additional data for the study is provided by enclosure.

1 Encl

R. A. DROPP
Captain, SC, USN
Commander

cc:
DLA-OW, Mr. Kirby

WORKSHEET - ALUMINUM SKIDS PROGRAM

1. Expenses for replacement of Aluminum Skids lost to the operating inventory because of wear, damage, loss, pilfering, placement in long term storage under an item of IPE and other reasons:

FY	AMOUNT ($)
FY 81	$180,180
FY 82	58,450
FY 83	119,232
FY 84	207,413

SOURCE: DIPEC-L, Budget Officer

WORKSHEET - ALUMINUM SKIDS PROGRAM

2. Personnel Expenses: (In operation of aluminum skids program)

Include Supervisory and Administrative support requirements (Not a part of operations overhead, which is one level or more above that of the function)

POSITION TITLE OR SKILL	GRADE	FULL TIME (F) PART TIME (P) INTERMITTENT (I)	ANNUAL SALARY	OTHER ENTITLEMENTS	OTHER PAY	(TOTAL) (COST)	DESCRIPTION OF DUTIES
DIPEC:							
Supply Clerk	GS-04/7	Full-time	$15,436	$5,557	--	($20,993)	Administrative
Supply Clerk	GS-04/10	Full-time	$16,723	6,020	--	(22,743)	Administrative
Student Aid	YW-3506-00	Part-time	3.35 per hr.	per hr	--	(** 2,371)	Administrative

* Other Entitlements include fringe benefits (36% of salary)

** Student Aid cost based on cost to government of $4.56 per hour x 520 hours (1/2 time).

SOURCE: DIPEC-ST

WORKSHEET - ALUMINUM SKIDS PROGRAM

2. Personnel Expenses: (In operation of aluminum skids program)

Include Supervisory and Administrative support requirements (Not a part of operations overhead, which is one level or more above that of the function).

POSITION TITLE OR SKILL	GRADE	TOTAL HOURS EXPENDED FY 84	HOURLY RATE $ (REPRESENTATIVE)	TOTAL COST	OTHER PAY & ENTITLEMENTS	DESCRIPTION OF DUTIES
b. DDMP:						
Warehouseman Foreman	WS-5	50	11.97	$ 578.50	N/A	Administrative/Supervisory
Warehouseman (FLO)	WG-6	250	9.14	2,210.00	N/A	Receiving/Issuing/Storing Dismantling of aluminum skids
Woodworker	WG-8	400	9.95	3,848.00	N/A	Assembly for use
				$6,636.50		

A-6

NOTE: The above hours and costs are estimates for FY 84. The workload associated with the aluminum skid program at DIPEC-M, Mechanicsburg, PA, is so minimal that costs are not tracked specifically for this program. Productive hours are documented for overall costs of receiving, storing, blocking, bracing, packing and shipping IPE. No distinction is made as to whether or not the above functions are performed with the use of wooden skids or aluminum skids. The use of aluminum skids at Mechanicsburg has been consistent for the past several years and the above estimates can be used for years 1981 through 1984.

SOURCE: DIPEC-M

WORKSHEET - ALUMINUM SKIDS PROGRAM

2. Personnel Expenses: (In operation of aluminum skids program)

Include Supervisory and Administrative support requirements (Not a part of operations overhead, which is one level or more above that of the function)

POSITION TITLE OR SKILL	GRADE	FULL TIME (F) PART TIME (P) INTERMITTENT (I)	ANNUAL SALARY	OTHER ENTITLEMENTS	OTHER PAY	DESCRIPTION OF DUTIES
c. DCSC:						
Warehousemen (FLO)	WG-6	F	$20,820	N/A	N/A	Receiving/issuing/storing and dismantling of aluminum skids. Assembling aluminum skid packages.
Warehousemen (FLO)	WG-5	F	17,742	N/A	N/A	Same as above.
Welder	WG-10	F	21,944 (50% of time provided or $10,992.80)		N/A	Skid fabrication and repair from F to condition A.
Welder	WG-10	F	$21,944 (50% of time provided or $10,992.80)	N/A	N/A	Same as above.
Welder Helper	WG-5	F	$17,742	N/A	N/A	Same as above.
Quality Assurance Specialist	GS-9	F	$21,606 (5% of time is spent on this element or $1,080.30	N/A	N/A	Provides inspection and surveillanc of repairs and skid storage.

A-7

WORKSHEET - ALUMINUM SKIDS PROGRAM

2. Personnel Expenses: (In operation of aluminum skids program)

Include Supervisory and Administrative support requirements (Not a part of operations overhead, which is one level or more above that of the function)

POSITION TITLE OR SKILL	GRADE	FULL TIME (F) PART TIME (P) INTERMITTENT (I)	ANNUAL SALARY	OTHER ENTITLEMENTS	OTHER PAY	DESCRIPTION OF DUTIES
c. DCSC:						
Laborer (stay-in-school program)	WW-1	P	$6.916.00	N/A	N/A	Dismantling of aluminum skids. Assi Preparing skid packages.
Laborer (stay-in school program)	WW-1	P	$6,916.00	N/A	N/A	Same as above.
Clerk	GS-4	F	$12,745 (5% of time utilized in this area or $637.25)	N/A	N/A	Administrative Support.
Supervisor Warehouse	WS-8	F	$27,943.00 (5% of time utilized in this area or $1,397.15)	N/A	N/A	Supervision and administrative.

A-8

WORKSHEET - ALUMINUM SKIDS PROGRAM

2. Personnel Expenses: (In operation of aluminum skids program)

Include Supervisory and Administrative support requirements (Not a part of operations overhead, which is one level or more above that of the function)

POSITION TITLE OR SKILL	GRADE	FULL TIME (F) PART TIME (P) INTERMITTENT (I)	ANNUAL SALARY	OTHER ENTITLEMENTS	OTHER PAY	DESCRIPTION OF DUTIES
Supervisor Support Branch	WS-11	F	$30,353 (5% of time is utilized in this area or $1,517.65)	N/A	N/A	Supervision and administrative.

NOTE: The above costs are estimates for FY 84. The cost for overhead and fringe benefits are not included in the FY 84 cost estimates. A percentage of time for the positions of supervisors, clerk and QA support have been provided. This information was extracted from FY 84 Federal pay scales, taking step increases into consideration. The two (2) welders provide services to the skid repair program by alternating every other week.

SOURCE: DIPEC-I

WORKSHEET - ALUMINUM SKIDS PROGRAM

2. Personnel Expenses: (In operation of aluminum skids program)

Include Supervisory and Administrative support requirements (Not a part of operations overhead, which is one level or more above that of the function)

POSITION TITLE OR SKILL	GRADE	FULL TIME (F) PART TIME (P) INTERMITTENT (I)	ANNUAL SALARY	OTHER ENTITLEMENTS	OTHER PAY	DESCRIPTION OF DUTIES
d. DDTC						
			(SKID LOT OPERATIONS-DIPEC-HHC)			
Forklift Opr (Whse Worker)	WG-06/05	Full Time	1827 Hrs @10.92 Hr	N/A	N/A	Controls all of the skids, i.e., receiving, shipping, storing and sends the repairables that are in Condition F to maintenance for repair. Drives MHE.
Whse Worker (Forklift Opr)	WG-05/05	Part-Time	(Cost included in the 1827 Hrs above)	N/A	N/A	Same as above.
			(SKID REPAIR-DIPEC-HED)			
Welder	WG-10/05	Full Time	1974 Hrs @27.50 Hr	N/A	N/A	Repairs skids from Condition F to Condition A.
Welder	WG-10/05	Part Time		N/A	N/A	Same as above.

SOURCE: DIPEC-H Manpower Position Control Report No. UPCB150A, Position Description, Federal Pay Scale, Subsidiary Cost Listing, Manhour Utilization Report (DIPEC-H local report).

WORKSHEET - ALUMINUM SKIDS PROGRAM

2. Personnel Expenses: (In operation of aluminum skids program)

Include Supervisory and Administrative support requirements (Not a part of operations overhead, which is one level or more above that of the function)

POSITION TITLE OR SKILL	GRADE	FULL TIME (F) PART TIME (P) INTERMITTENT (I)	ANNUAL SALARY	OTHER ENTITLEMENTS	OTHER PAY	DESCRIPTION OF DUTIES
SENECA (Also previously furnished by DIPEC-L letter, 14 Nov 84).						
Production Machinery Mechanic Foreman	WS-08	P-96 Hrs	$26,811	None	None	Supervise Management of SKID Control and Inventory
Production Machinery Mechanic	WG-8	P-720 Hrs	$20,197	None	None	Assemble/Disassemble/Store/ Inventory/Prepare Documentation on SKIDS
Supply Clerk	GS-5	P-96	$13,903	None	None	Maintain Accountable Records
Supply Clerk	GS-03	P-48 Hrs	$11,070	None	None	Perform Annual Inventory

SOURCE:

WORKSHEET - ALUMINUM SKIDS PROGRAM

2. Personnel Expenses: (In operation of aluminum skids program)

Include Supervisory and Administrative support requirements (Not a part of operations overhead, which is one level or more above that of the function)

POSITION TITLE OR SKILL	GRADE	FULL TIME (F) PART TIME (P) INTERMITTENT (I)	ANNUAL SALARY	OTHER ENTITLEMENTS	OTHER PAY	DESCRIPTION OF DUTIES

DIPEF

PERSONNEL EXPENSES (ATCHISON)

1 each Stock Clerk at $13.82 per hour x 500 hours per year = $6,910.00

SOURCE: DIPEC-STM

WORKSHEET - ALUMINUM SKIDS PROGRAM

3. SHOP COST:

MATERIAL/SUPPLIES	EQUIPMENT NAME & FSC	COST	YEAR OF PURCHASE	REMAINING YRS OF USEFULNESS	AMOUNT OF SPACE FOR STORAGE/REPAIR/OFFICES

Our evaluation indicates comparable cost for equipment required for use with wood or aluminum skids repair or preparation for shipment. Any equipment required to supply wood skids would require new purchases (e.g., pneumatic nailers, wood hole drillers, nails, etc) whereas metalworking equipment for aluminum skids can be obtained from General Reserve Assets.

WORKSHEET - ALUMINUM SKIDS PROGRAM

4. TRANSPORTATION COSTS: (FY 84)

a. (1) Skid Comp/Pkgs from Central Storage to field activities preparing IPE for Shipment	(2) Skid Comp/Pkgs from point of last use back to Central Storage
$64,621.00	$19,602.00

b. New /aluminum skids components from factory to central storage if not included in #1.	c. Damaged aluminum skid components from (secondary) ss to any of (primary or secondary) storage (ex. from DIPEF to DCSC).
$7,904.00	$178.00 (Mechanicsburg to Columbus - Only move in FY 84)

TOTAL = $92,305

SOURCE: DIPEC-STM

WORKSHEET - ALUMINUM SKIDS PROGRAM

5. ALL DIRECT SHIPMENTS FOR FY 81, 82, 83, 84:

	a. From user to storage				b. From user of IPE to Re. Fac and back to user of IPE				c. From user to user				d. From storage to user			
FY	TOTAL	ON ALUM SKIDS	WOOD SKIDS	NO SKIDS	TOTAL	ON ALUM SKIDS	WOOD SKIDS	NO SKIDS	TOTAL	ON ALUM SKIDS	WOOD SKIDS	NO SKIDS	TOTAL	ON ALUM SKIDS	WOOD SKIDS	NO SKIDS
FY 81	Because of the IPE scope and threshold change effective in FY 82, 81 and 82 data is not applicable to current IPE Operations.															
FY 82	---	---	---	---	---	---	---	---	---	---	- -	---	---	---	---	---
FY 83	2022	1677	345	18	89	89	0	0	761	723	38	0	1428	1074	354	0
FY 84	1920	1613	307	16	107	107	0	0	785	739	46	0	895	731	164	0
YR AVG	1971	1645	326	17	98	98	0	0	773	731	42	0	1162	903	259	0

SOURCE: DIPEC-STM (Mr. Schewe)

6. Estimate of number of aluminum skids presently in inventory:

a. EST. NO. OF SKIDS IN STORAGE UNDER IPE	b. EST. NO. OF SKID PACKAGES IN TRANSIT	c. EST. NO. OF SKIDS CAN BE OBTAINED FROM COMPONENTS NOW IN STORAGE
8,821	72	TO CARRY 6' x 4' (1,000 lbs) 18% = 1512 TO CARRY 8' x 6' (3,000 lbs) 22% = 1413 TO CARRY 10' x 6' (8,000 lbs) 27% = 1514 TO CARRY 14' x 8' (22,000 lbs) 24% = 934 TO CARRY 17' x 8' (40,000 lbs) 9% = 228 5601

WEIGHT OF ALL ALUMINUM SKID COMPONENTS IN LAST INVENTORY (BASED ON 6c ABOVE): 1,637,463 lbs

NUMBER OF SKIDS	DESCRIPTION	WEIGHT OF ONE (lbs)	WEIGHT OF ALL (lbs)
1512	6' x 4' skid (runners, headers, tie bars, mtg plates) =	195	294,743
1413	8' x 6' skid ( ) =	255	360,242
1514	10' x 6' skid ( ) =	292	442,115
934	14' x 8' skid ( ) =	421	392,991
228	17' x 8' skid ( ) =	648	142,372
			1,637,463 lb

SOURCE: DIPEC-S

WORKSHEET - ALUMINUM SKIDS PROGRAM

6. ESTIMATE OF NUMBER OF ALUMINUM SKIDS PRESENTLY IN INVENTORY (CONT'D):

a. EST. NO. OF SKIDS IN STORAGE UNDER IPE: 8,821

TO CARRY 6' x 4' (1,000 lbs) 18% =	1588
TO CARRY 8' x 6' (3,000 lbs) 22% =	1940
TO CARRY 10' x 6' (8,000 lbs) 27% =	2382
TO CARRY 14' x 8' (22,000 lbs) 27% =	2382
TO CARRY 17' x 8' (40,000 lbs) 9% =	794
	8821

b. EST. NO. OF SKID PACKAGES IN TRANSIT: 72

TO CARRY 6' x 4' (1,000 lbs) 18% =	13
TO CARRY 8' x 6' (3,000 lbs) 22% =	16
TO CARRY 10' x 6' (8,000 lbs) 27% =	19
TO CARRY 14' x 8' (22,000 lbs) 24% =	17
TO CARRY 17' x 8' (40,000 lbs) 9% =	7
	72

TOTAL WEIGHT OF ALL ALUMINUM SKID COMPONENTS PRESENTLY IN INVENTORY (BASED ON 6a-c, pp. A-16 AND A-17): 4,568,750 lbs

DESCRIPTION	TOTAL NUMBER OF SKIDS (6a + 6b + 6c)	x	WEIGHT OF ONE (LBS)	=	TOTAL WEIGHT (LBS)
6' X 4' Skid	1588 + 13 + 1512		195		607,035
8' X 6' Skid	1940 + 16 + 1413		255		860,115
10' X 6' Skid	2382 + 19 + 1514		292		1,143,180
14 X 8' Skid	2117 + 17 + 934		421		1,291,628
17' X 8' Skid	794 + 7 + 228		648		666,792
					4,568,750

SOURCE: DIPEC-S

7. Est. economic life of wood and aluminum skids under DIPEC operating conditions:

DESCRIBE METHODOLOGY/ASSUMPTIONS/SOURCE:

Number 7:

We know of no totally valid method to estimate the economic life of wood and aluminum skids under DIPEC operating conditions. As long as the skidded item remains in storage the economic life is almost indefinite for both wood and aluminum. Wood, however, does tend to deteriorate during long term storage under the low humidity required for the storage of IPE. Under these conditions wood tends to dry out, split and warp. For these reasons additional costs are incurred in the use of wood skids because all tie down bolts must be loosened prior to long term storage to prevent damage to a machine due to warping of wood skid components. Prior to shipment wood skid components must be checked for straightness, replaced if necessary and tie down bolts retightened.

This is one of the reasons the Army has elected to use aluminum skids for long term storage of PEP items. DIPEC has recently purchased a large number of skid components for the Army for this purpose.

Wood skids are not normally used for more than one shipment. When an item is shipped into storage on wood skids it is normally stored and if subsequently reshipped the same skids are used. Previous studies have estimated overall reuse factor of wood skids to be 10% and the reuse factor for aluminum skids at 8 times. This means the average wood skid would be reused one time in 10 while the average aluminum skid would be reused 8 times during their respective economic lives. We have not been able to come up with anything that indicates these estimates are invalid. However, the DLA-LO IOM to DLA-LP, dated 3 Nov 81, subject: Cost Benefits Study on the Use of Aluminum vs. Wood Skids in Transporting Industrial Plant Equipment Within the DoD, questioned the 1.10 reuse factor and indicated that this factor should possibly be higher. Even though there is no basis for it we will use the reuse factor of 25% mentioned in the IOM.

Historical data shows the general reserve turns over approximately once every four years. Thus the average item in the General Reserve remains in storage approximately four years. If we assume that for every shipment of an item into storage there is a shipment of an item out of storage and that the reuse factors of 1.25 for wood and 8 for aluminum are valid, the following is our best estimate of the average economic life of wood and aluminum skids:

Wood skids - 4 years x 50% x 1.25 = 2.5 years

Aluminum skids - 4 years x 50% x 8 = 16 years

Where: 4 years = average length of time in storage for General Reserve

50% = percentage of shipments into storage

1.25 = reuse factor for wood skids

8 = reuse factor for aluminum skids

SOURCE: DIPEC-IR (Mr. Mears) 6955

WORKSHEET - ALUMINUM SKIDS PROGRAM

8. Estimated weight of aluminum skid and wooden skid & list elements for each:

a. SIZE	LOAD IN LBS (TO SUPPORT)	WEIGHT OF ALUM SKIDS	WEIGHT OF WOOD SKIDS
6' x 4"	1000	195	113

ALUMINUM ELEMENTS:

4- 6.0 ft runner
3990-SKID-4009

2- 4.0 ft header
3990-SKID-4005

2-2.0 ft tie bar
3990-SKID-6538

4 mount plates
3990-SKID-6501

72 hex nut
3990-SKID-6219

72 bolt
3990-SKID-6584

72 flat washer
3990-SKID-6601

72 lock washer
3990-SKID-6602

1950 ship wt

WOOD ELEMENTS

2 ea 6' Runners (4 x 4)

2 ea 4' Headers (4 x 4)

8 ea 4' Flooring (2 x 6)

8 ea 8" Bolts, 1/2" dia.

100 Cement coated nails

113 pounds estimated total weight

b.

SIZE	LOAD IN LBS	WEIGHT OF ALUMINUM SKIDS	WEIGHT OF WOOD SKIDS
8' x 6'	3000	255	392

ALUMINUM ELEMENTS:

4- 8.0 ft runner
3990-SKID-4013

2- 6.0 ft header
3990-SKID-4009

2-3.0 ft tie bar
3990-SKID-6540

4 mount plates
3990-SKID-6501

72 hex nut
3990-SKID-6219

72 bolt
3990-SKID-6584

72 flat washer
3990-SKID-6601

72 lock washer
3990-SKID-6602

255# ship wt

WOOD ELEMENTS:

3 ea	8'	Runner (4 x 4)
2 ea	6'	Header (4 x 4)
10 ea	6'	Flooring (2 x 6)
12 ea	8"	Bolts, 1/2" dia.
100		Concrete coated nails
392 pounds		estimated total weight

8. Continued (Est. weight of aluminum & wood skid & elements of each:

c. SIZE	LOAD IN LBS	WEIGHT OF ALUMINUM SKIDS	WEIGHT OF WOOD SKIDS
10' x 6'	8,000	292	648

ALUMINUM ELEMENTS:

4-10.0 ft runner
3990-SKID-4017

2- 6.0 ft header
3990-SKID-4009

2- 3.0 ft tie bar
3990-SKID-6540

4 mount plates
3990-SKID-6501

72 hex nut
3990-SKID-6219

72 bolt
3990-SKID-6584

72 flat washer
3990-SKID-6601

72 lock washer
3990-SKID-6602

292# ship wt

WOOD ELEMENTS

5 ea	10'	Runners	(4 x 4)
2 ea	6'	Headers	(4 x 4)
12 ea	6'	Flooring	(2 x 8)
20 ea	8"	Bolts, 1/2" dia.	
150		Concrete coated nails	
648 pounds		estimated total weight	

8. Continued (Est. weight of aluminum & wood skid & elements of each):

d. SIZE	LOADS IN LBS	WEIGHT OF ALUMINUM SKIDS	WEIGHT OF WOOD SKIDS
14' x 8'	22,000	421 lbs	1437 lbs

ALUMINUM ELEMENTS:

4-14.0 ft runner
3990-SKID-4023

2- 8.0 ft header
3990-SKID-4013

4-4.0 ft tie bar
3990-SKID-6542

6 mount plates
3990-SKID-6501

100 hex nut
3990-SKID-6219

100 bolt
3990-SKID-6584

100 flat washer
3990-SKID-6601

100 lock washer
3990-SKID-6602

421# ship wt

WOOD ELEMENTS

3 ea	14'	Runner (8 x 6)
2 ea	8'	Header (8 x 6)
16 ea	8'	Flooring (2 x 8)
20 ea	8"	Bolts, 1/2" dia.
150		Concrete coated nails

648 pounds estimated total weight

8. Continued (Est. weight of aluminum & wood skid & elements of each):

e. SIZE	LOADS IN LBS	WEIGHT OF ALUMINUM SKIDS	WEIGHT OF WOOD SKIDS
17' x 8 '	40,000	648 lb	2454

ALUMINUM ELEMENTS

6-17.0 ft. runner
3990-SKID-4013

2-8.0 ft header
3990-SKID-4013

4-4.0 ft tie bar
3990-SKID-6542

8 mount plates
3990-SKID-6501

128 hex nut
3990-SKID-6219

128 bolt
3990-SKID-6584

128 flat washer
3990-SKID-6601

128 lock washer
3990-SKID-6602

648# ship wt

WOOD ELEMENTS:

6 ea	17' Runner	(8 x 6)
2 ea	8' Header	(8 x 6)
16 ea	8' Flooring	(2 x 10)
24 ea	16" Bolts, 5/8" dia.	
350	Concrete coated nails	

2454 pounds estimated total weight

SOURCE: DIPEC-S

WORKSHEET - ALUMINUM SKIDS PROGRAM

9.a. WOOD SKID (READY FOR USE ** COST ESTIMATES IN REGION AROUND STORAGE SITE.)

1. DDMP AREA	SIZE	LOAD IN LBS	COST ESTIMATE
	6' x 4'	1,000	*
	8' x 6	3.000	*
	10' x 6'	8,000	*
	14' x 8'	22,000	*
	17' x 8'	40,000	*

*No cost figures available at DIPEC-M

** Not applicable, all wood skids fabricated in-house

SOURCE: DIPEC-M

WORKSHEET - ALUMINUM SKIDS PROGRAM

9.a. WOOD SKID (READY FOR USE * COST ESTIMATES (IN REGION AROUND STORAGE SITE.)

2. DCSC SIZE LOAD IN LBS COST ESTIMATE

SIZE	LOAD	$ MATERIALS	$ LABOR	TOTAL COST
6' x 4'	1,000	$ 33.60	$87.25	$ 120.85
8' x 6'	3,000	$ 50.23	$87.25	137.48
10' x 6'	8,000	$ 71.36	$87.25	158.61
14' x 8'	22,000	238.00	222.00	460.00
17' x 8'	40,000	638.67	222.00	860.67

SOURCE: *Current price list from Supply.

WORKSHEET - ALUMINUM SKIDS PROGRAM

9.b. COST ESTIMATE FOR WOOD SKIDS FABRICATED IN-HOUSE:

1. DDMP	SIZE	LOAD IN LBS	TOTAL	COST ESTIMATE
	6' x 4'	1,000	$ 244.80	Est. material $118.80; Est. labor $126.60 6 hrs @ 21
	8' x6'	3,000	279.40	Est. material $132.40; Est. labor $147.00; 7 hrs.
	10' x 6'	8,000	466.50	Est. material $256.50; Est. labor $210.00; 10 hrs
	14' x 8'	22,000	989.00	Est. material $485.00; Est. labor $504.00; 24 hrs.
	17' x 8'	40,000	1,322.00	Est. material $650.00; Est. labor $672.00; 32 hars.

METHODOLOGY: MIL-HDBK-701B

ASSUMPTION: Configuration of weight and aize of machine tool, dictates type and size of skid

SOURCE: Material is procured through DDMP Base Supply

(If wood skids are procured from commercial sources, add column above in right hand column to indicate most cost and source.) If wood skids are not procured, indicate wood skids not procured.

WORKSHEET - ALUMINUM SKIDS PROGRAM

9. b. COST ESTIMATE FOR WOOD SKIDS FABRICATION IN-HOUSE:

2. ATCHISON
(COST FOR MANUFACTURING WOOD SKIDS)

SIZE	LOAD IN LBS	COST ESTIMATE (LABOR)	(MATERIAL)	TOTAL COST
6' x 4'	1,000	($109.27)	($ 78.18)	$ 187.45
8' x 6'	3,000	(124.88)	(241.17)	366.15
10' x 6'	8,000	(156.10)	(249.26)	405.36
14' x 8'	22,000	(218.54)	(567.64)	786.18
17' x 8'	40,000	(280.98)	(812.55)	1,093.53

SOURCE: DIPEF, ATCHISON, MR. Bud Kocour, 18 Mar 1985

WORKSHEET - ALUMINUM SKIDS PROGRAM

10. Weight of Aluminum Skid Components transferred to Disposal:

FY	WEIGHT
FY 81	* NOT AVAILABLE
FY 82	*NOT AVAILABLE
FY 83	1,854 LBS
FY 84	4,011 LBS

SOURCE: DIPEC-S

Appendix B

Aluminum and Wooden Skid Illustrations

SKID MEMBER (6 IN.) . . . . . 4.6 LB/FT
AUXILIARY TIE BAR . . . . . 2.0 LB/FT
MOUNTING PLATE . . . . . 4.0 LB EACH

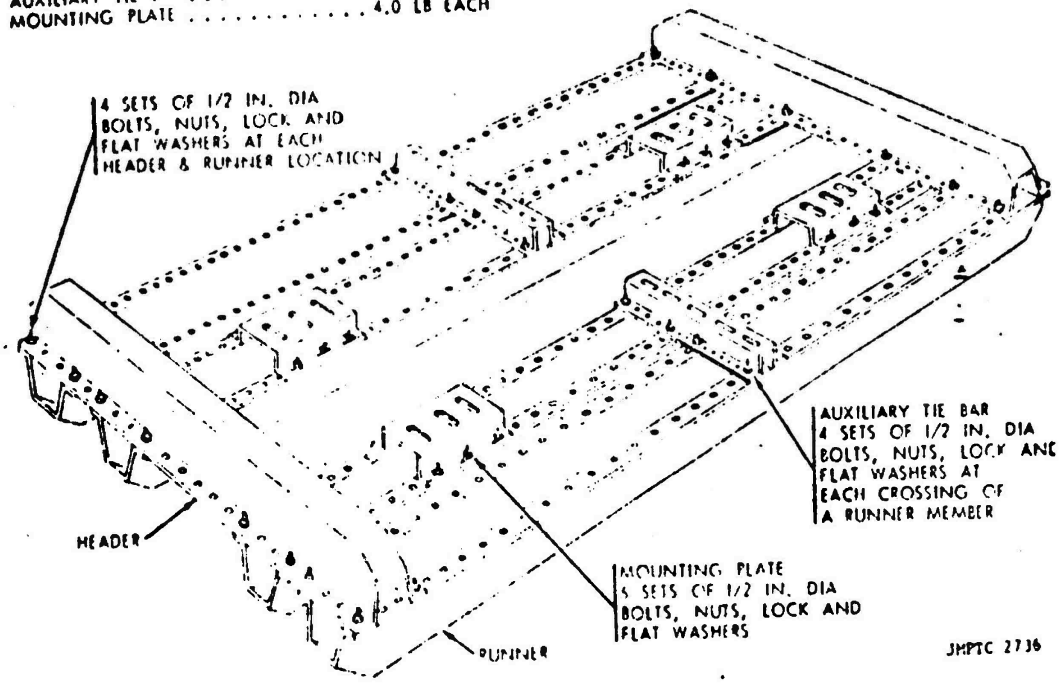
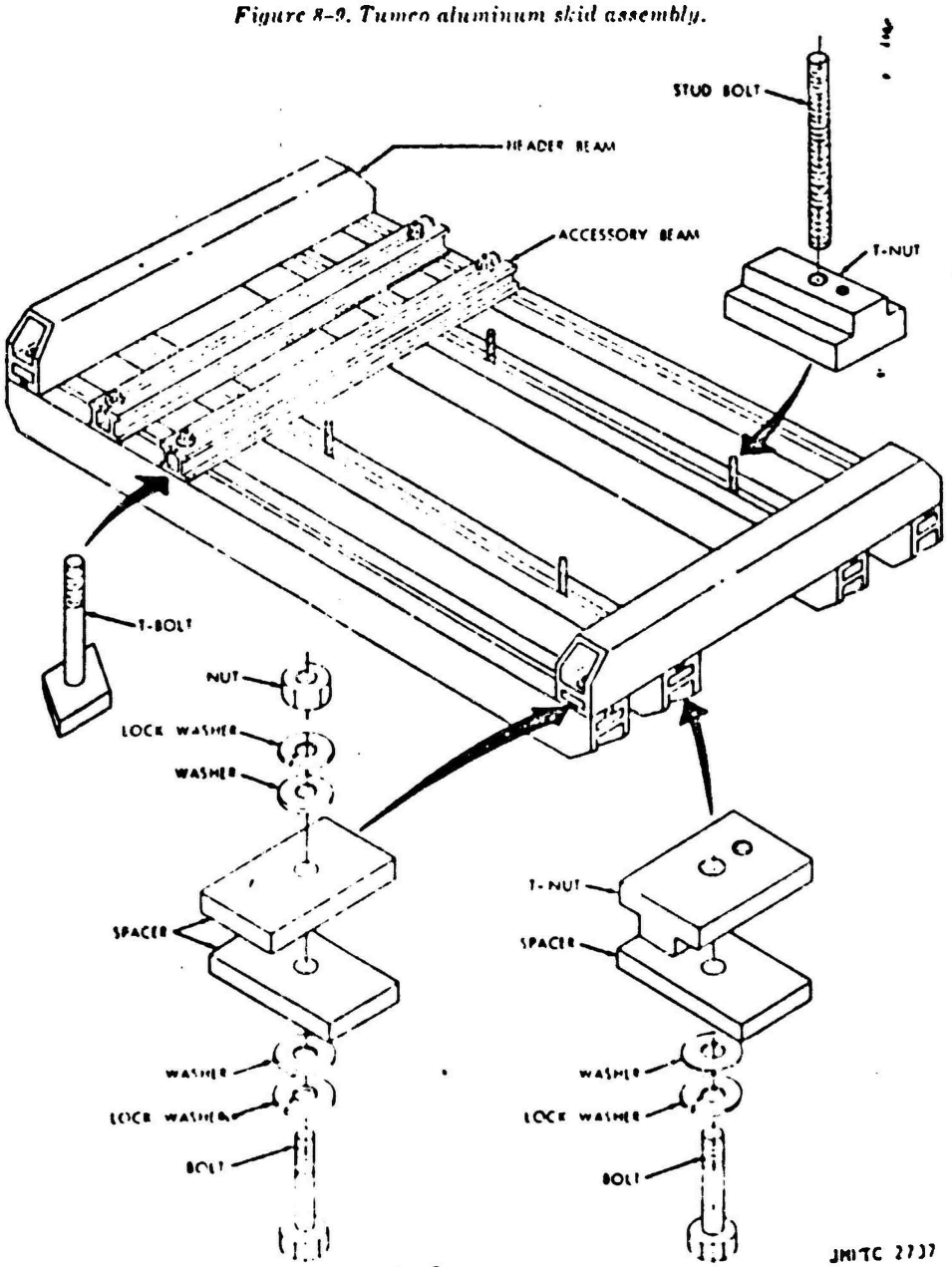


Figure 8-9. Tumco aluminum skid assembly.



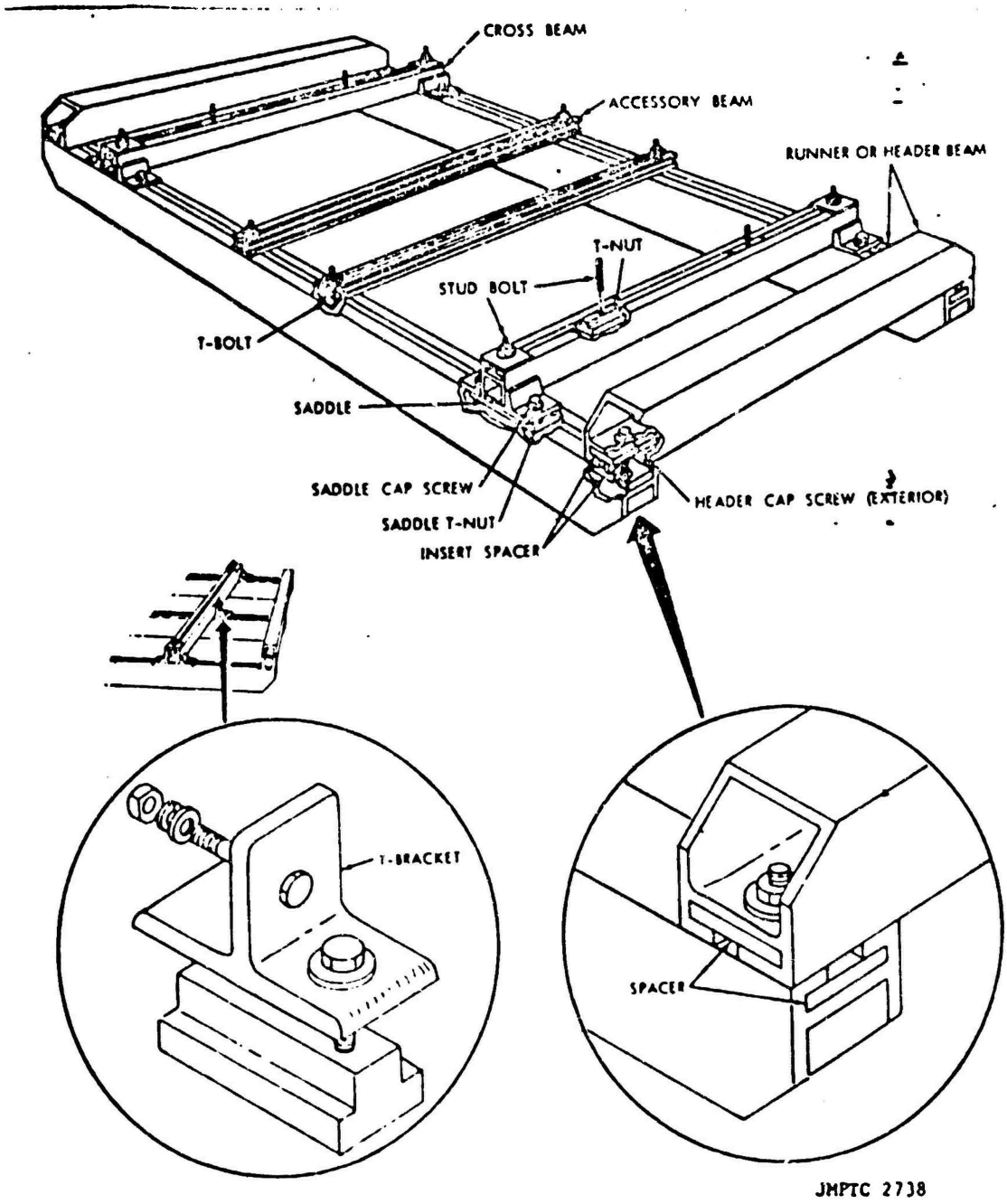


Figure B-11. Harvey crossbeam skid.

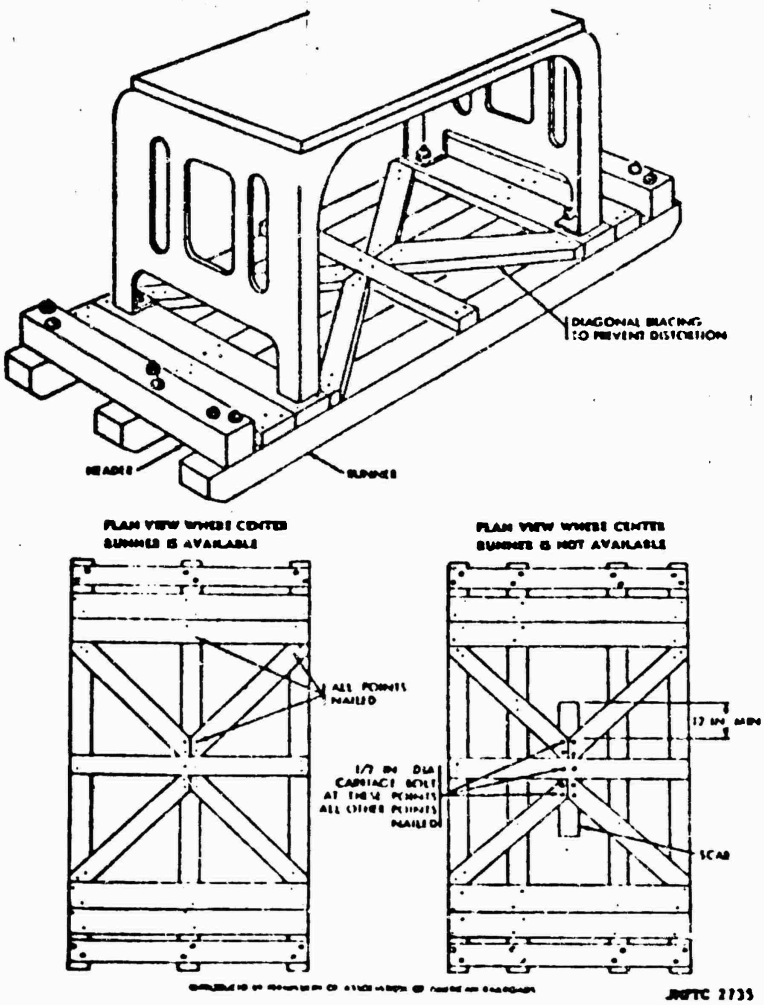


Figure 8-8. Diagonal flooring for skid platform.

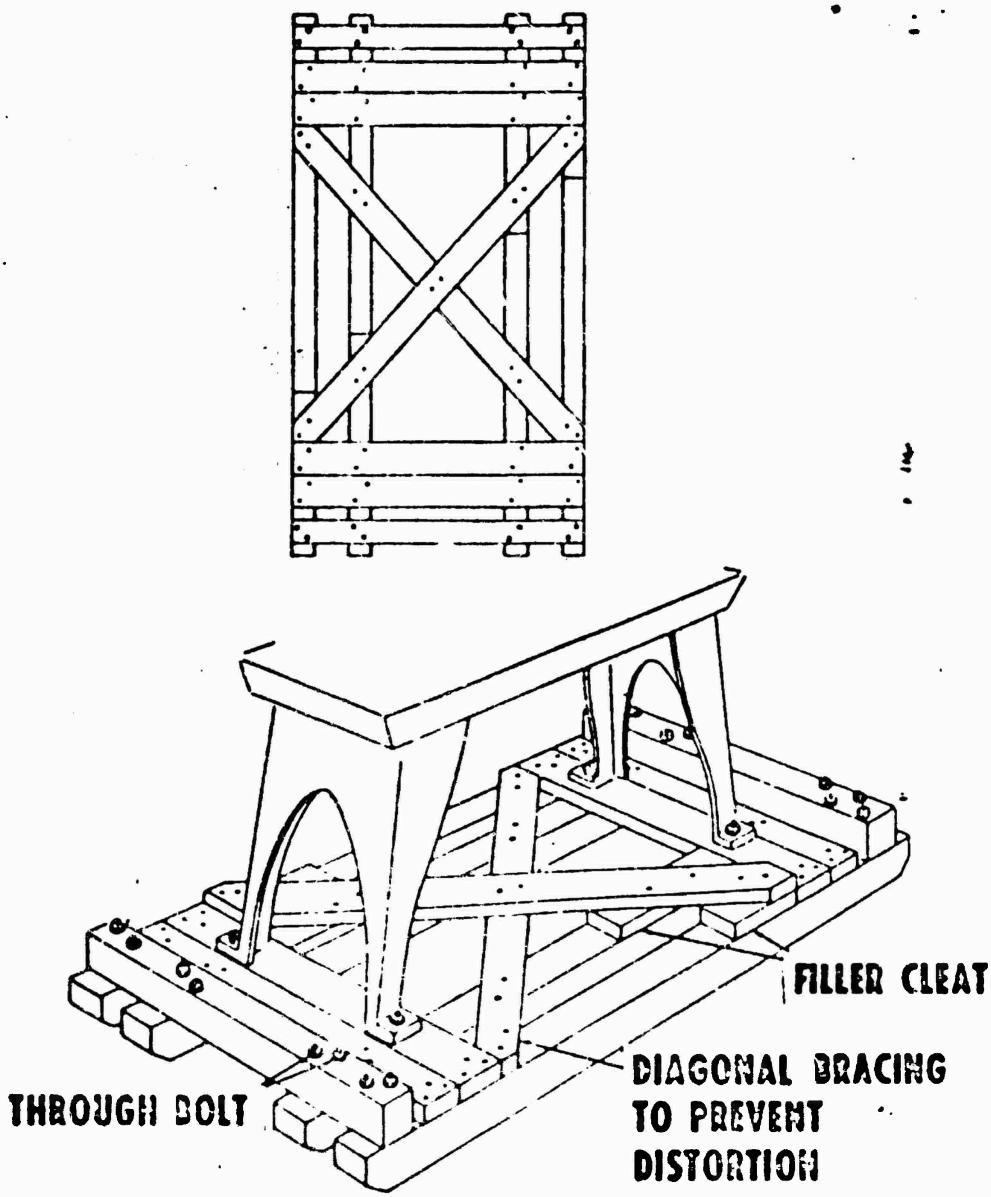


Figure 8-7 Skid arrangement, leg type machines.

Appendix C

Schedule of Personnel Costs

Appendix C

Schedule of Personnel Costs

PERSONNEL COSTS

ACTIVITY	POSITION TITLE	GRADE	TpEmp(f=0,p=1 i=2,ong=3,og=4)	HOURS EMP	LEAVE ALLOW	RATE/HR	ANNUAL WAGES	OTHER ENTITLES	FRINGE BENEFITS	FICA	OTHER PAY	TOTAL PERS COSTS	REMARKS
DIPEC	Supply Clerk	GS4	0	2087	2087	7.40	15,443.80		5,590.66	0.00		$21,034	
	Supply Clerk	GS4	0	2087	2087	8.01	16,723.00		6,053.73	0.00		$22,777	
	Student Aid	VW3506	4	520	613.6	3.35	2,055.56		0.00	144.92		$2,200	
DOMP	Warehouse Foreman	WS5	1	50	59	11.97	706.23		255.66	0.00		$962	
	Warehouseman	WG6	1	250	295	9.14	2,696.30		976.06	0.00		$3,672	
	Woodworker	WG8	1	400	472	9.95	4,696.40		1,700.10	0.00		$6,396	
DCSC	Warehouseman	WG6	0	2087	2087	9.24	19,283.88		6,980.76	0.00		$26,265	
	Warehouseman	WG5	0	2087	2087	8.82	18,407.34		6,663.46	0.00		$25,071	
	Welder	WG10	0	1043	1043	10.92	11,389.56		4,123.02	0.00		?15,513	
	Welder	WG10	0	1044	1044	10.92	11,400.48		4,126.97	0.00		$15,527	
	Welder Helper	WG5	0	2087	2087	8.82	18,407.34		6,663.46	0.00		$25,071	
	Quality Assur Spec	GS9	1	104	122.72	11.84	1,453.12		526.03	0.00		$1,979	
	Laborer (Stay in School)	WW1	4	1040	1227.2	6.83	8,381.78		0.00	590.92		$8,973	
	Laborer (Stay in School)	WW1	4	1040	1227.2	6.83	8,381.78		0.00	590.92		$8,973	
	Clerk	GS4	1	104	122.72	6.99	857.22		310.31	0.00		$1,168	
	Warehouse Supv	WS8	1	104	122.72	13.36	1,639.54		593.51	0.00		$2,233	
	Supv Supp Br	WS11	1	104	122.72	14.63	1,795.39		649.93	0.00		$2,445	
DDTC	Forklift Operator	WG6	0	2087	2087	10.92	22,790.04		8,249.99	0.00		$31,040	1725 hrs is the annual productive
	Forklift Operator	WG5	1	102	120.36	10.12	1,218.04		440.93	0.00		$1,659	time at DDTC.1827-1725=102 hrs
	Welder	WG10	0	2087	2087	12.72	26,546.64		9,609.88	0.00		$36,157	worked by the part time.Also,1974-1725=2
	Welder	WG10	1	249	293.82	12.72	3,237.39		1,352.94	0.00		$5,030	
SENECA	Prod Mach Mech Frmn	WS8	1	96	113.28	13.48	1,527.01		552.78	0.00		$2,080	
	Prod Mach Mech	WG8	1	720	849.6	10.20	8,665.92		3,137.06	0.00		$11,803	
	Supply Clerk	GS5	1	96	113.28	7.82	805.85		320.68	0.00		$1,207	
	Supply Clerk	GS3	1	48	56.64	6.22	352.30		127.53	0.00		$480	
DIPEF	Stock Clerk	-	3	500	500	13.82	6,910.00		0.00	0.00		$6,910	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
					0		0.00		0.00	0.00		$0	
												$286,684.11	

Appendix D

Transportation Rates

Transportation Rates

16 AUG 85 DEPOT WEIGHT CLASS FREIGHT COSTS - QTRS 841 TO 852
19:16:20 DEFENSE GENERAL SUPPLY CENTER IPL 4446 OS/VS2 MVS

DESCRIPTION OF SUBP

CRITERION VARIABLE CHGLB
BROKEN DOWN BY WEIGHT
BY DEPOT

VARIABLE	VALUE	LABEL	MEAN	STD DEV	CASE
FOR ENTIRE POPULATION			.0887	.0710	67819
WEIGHT	1.00	NEAR 1000 LBS	.1208	.0763	3081
DEPOT	1.00	DGSC	.1101	.0721	503
DEPOT	2.00	DCSC	.1236	.0630	252
DEPOT	3.00	DDMP	.1091	.0667	571
DEPOT	4.00	DDTC	.1338	.1263	531
DEPOT	5.00	DDOU	.1326	.0550	375
DEPOT	6.00	DDMT	.1208	.0467	842
WEIGHT	2.00	NEAR 3000 LBS	.0914	.0575	15769
DEPOT	1.00	DGSC	.0846	.0436	250
DEPOT	2.00	DCSC	.0936	.0477	101
DEPOT	3.00	DDMP	.0806	.0523	2935
DEPOT	4.00	DDTC	.0862	.0940	269
DEPOT	5.00	DDOU	.1056	.0485	227
DEPOT	6.00	DDMT	.0977	.0394	433
WEIGHT	3.00	NEAR 8000 LBS	.0697	.0417	743
DEPOT	1.00	DGSC	.0613	.0418	117
DEPOT	2.00	DCSC	.0635	.0363	425
DEPOT	3.00	DDMP	.0630	.0443	112
DEPOT	4.00	DDTC	.0642	.0595	1186
DEPOT	5.00	DDOU	.0841	.0285	1424
DEPOT	6.00	DDMT	.0728	.0327	2076
WEIGHT	4.00	NEAR 22000 LBS	.0294	.0242	670
DEPOT	1.00	DGSC	.0315	.0302	151
DEPOT	2.00	DCSC	.0307	.0148	360
DEPOT	3.00	DDMP	.0173	.0192	1039
DEPOT	4.00	DDTC	.0257	.0259	1223
DEPOT	5.00	DDOU	.0372	.0265	670
DEPOT	6.00	DDMT	.0337	.0170	1905
WEIGHT	5.00	NEAR 43000 LBS	.0197	.0164	7116
DEPOT	1.00	DGSC	.0178	.0170	1521
DEPOT	2.00	DCSC	.0221	.0108	117
DEPOT	3.00	DDMP	.0143	.0191	365
DEPOT	4.00	DDTC	.0222	.0189	1673

Appendix E

Weight Differential Transportation Costs

Appendix E

Weight Differential Transportation Costs

erence pages 15 - 19 of Appendix A.

Si	oad	Weight Alum Skid	Weight Wood Skid	Weight Difference
6′	000	195	113	82
8′ x	000	255	392	-137
10′ x	000	292	648	-356
14′ x	000	421	1,437	-1,016
17′ x	000	648	2,454	-1,806

t To Be Added to Aluminum Skids Total:

S	d	Weight Difference	Number Shipped	Total Weight	Cost/LB	Total Cost
6′ ..	00	82	608	49,856	.1208	6,023

t To Be Added to Wood Skids Total:

Si	d	Weight Difference	Number Shipped	Total Weight	Cost/LB	Total Cost
8′	0	137	743	101,791	.0914	9,304
10′	0	356	912	324,672	.0697	22,630
14′	0	1,016	810	822,960	.0294	24,195
17′	0	1,806	304	549,024	.0197	10,815
						66,945

Appendix F

Number of Shipments by Size and Load

Appendix F

Number of Shipments by Size and Load

SKID SIZE	LOAD	PERCENTAGE OF TOTAL SHIPPED	ESTIMATED NUMBER OF SHIPMENTS BY SIZE
6′ x 4′	1,000	18%	3377 x .18 = 608
8′ x 6′	3,000	22%	3377 x .22 = 743
10′ x 6′	8,000	27%	3377 x .27 = 912
14′ x 8′	22,000	24%	3377 x .24 = 810
17′ x 8′	40,000	9%	3377 x .09 = 304

Appendix G

Format A - Aluminum and Wood Alternatives

• **Format A - Aluminum and Wood Alternatives**

ECONOMIC ANALYSIS PROGRAM - Format A

PROJECT: Skidding of IPE RATE(F2): 0.1

ALTERNATIVE: Wood skids DATE: 9-17-85

ECONOMIC LIFE: 25

YR	NRC-COST	REC COST	TOTAL COST	DISCOUNT	DISCOUNTED COST
1		694922	694922	0.954	$662,832.95
2		694922	694922	0.867	$602,575.41
3		694922	694922	0.788	$547,795.82
4		694922	694922	0.717	$497,996.20
5		694922	694922	0.651	$452,723.82
6		694922	694922	0.592	$411,567.11
7		694922	694922	0.538	$374,151.92
8		694922	694922	0.489	$340,138.11
9		694922	694922	0.445	$309,216.46
10		694922	694922	0.405	$281,105.87
11		694922	694922	0.368	$255,550.79
12		694922	694922	0.334	$232,318.90
13		694922	694922	0.304	$211,199.00
14		694922	694922	0.276	$191,999.09
15		694922	694922	0.251	$174,544.63
16		694922	694922	0.228	$158,676.94
17		694922	694922	0.208	$144,251.76
18		694922	694922	0.189	$131,137.96
19		694922	694922	0.172	$119,216.33
20		694922	694922	0.156	$108,378.48
21		694922	694922	0.142	$98,525.89
22		694922	694922	0.129	$89,568.99
23		694922	694922	0.117	$81,426.36
24		694922	694922	0.107	$74,023.96
25		694922	694922	0.097	$67,294.51
26			0	0.000	$0.00
27			0	0.000	$0.00
28			0	0.000	$0.00
29			0	0.000	$0.00
30			0	0.000	$0.00
TOT	$0.00	**********	$17,373,050.00	9.523603	$6,618,217.29

Total Discounted Cost: $6,618,217.29

Uniform Annual Cost (UAC): $694,922.00

Existing Assets Replaced (EAR)(Discounted).....: $2,284,375.00

UAC with EAR: $455,059.48

Terminal Value (T.V.)(Discounted): 0

UAC with T.V. and EAR:.....: $455,059.48

ECONOMIC ANALYSIS PROGRAM - Format A

PROJECT: Skidding of IPE RATE(F2): 0.1

ALTERNATIVE: Aluminum skids DATE: 10-8-85

ECONOMIC LIFE: 25

YR	NRC-COST	REC COST	TOTAL COST	DISCOUNT	DISCOUNTED COST
1		773126	773126	0.954	$737,425.76
2		773126	773126	0.867	$670,387.05
3		773126	773126	0.788	$609,442.78
4		773126	773126	0.717	$554,038.89
5		773126	773126	0.651	$503,671.72
6		773126	773126	0.592	$457,883.38
7		773126	773126	0.538	$416,257.62
8		773126	773126	0.489	$378,416.02
9		773126	773126	0.445	$344,014.56
10		773126	773126	0.405	$312,740.51
11		773126	773126	0.368	$284,309.55
12		773126	773126	0.334	$258,463.23
13		773126	773126	0.304	$234,966.57
14		773126	773126	0.276	$213,605.98
15		773126	773126	0.251	$194,187.25
16		773126	773126	0.228	$176,533.86
17		773126	773126	0.208	$160,485.33
18		773126	773126	0.189	$145,895.76
19		773126	773126	0.172	$132,632.50
20		773126	773126	0.156	$120,575.00
21		773126	773126	0.142	$109,613.64
22		773126	773126	0.129	$99,648.76
23		773126	773126	0.117	$90,589.79
24		773126	773126	0.107	$82,354.35
25		773126	773126	0.097	$74,867.59
26			0	0.000	$0.00
27			0	0.000	$0.00
28			0	0.000	$0.00
29			0	0.000	$0.00
30			0	0.000	$0.00
TOT	$0.00	$19,328,150.00	$19,328,150.00	9.524	$7,363,007.45

Total Discounted Cost: $7,363,007.45

Uniform Annual Cost (UAC): $773,126.00

Existing Assets Replaced (EAR)(Discounted).....: $0.00

UAC with EAR: $773,126.00

Terminal Value (T.V.)(Discounted): 221584.38

UAC with T.V. and EAR:.....: $749,859.33

Appendix H

Aluminum Skids Price Lists

LENGTH	TYPE I - TUMCO	TYPE II - HARVEY	HARVEY S1	LENGTH	TYPE I - TUMCO	TYPE II - HARVE
2	4001 15.85	NL37 15.75		22	4031 175.00	1028 136.27
2½	4002 19.80	1001 19.48		23	4032 183.00	1029 141.99
3	4003 23.75	1002 23.11		24	4033 190.00	1030 147.74
3½	4004 27.70	1003 26.67		25	4034 195.00	1031 153.49
4	4005 31.65	1004 30.13	NL01 31.21	26	4035 200.00	1032 159.07
4½	4006 35.60	1005 33.47		27	4036 205.00	1033 164.67
5	4007 39.55	1006 36.91	NL02 36.21	28	4037 212.00	1034 170.24
5½	4008 43.50	1007 40.19		29	4038 221.00	1035 175.77
6	4009 47.45	1008 43.38	3001 41.21	30	4039 230.00	1036 181.26
6½	4010 51.40	1009 46.50		31		1037 186.70
7	4011 55.30	1010 49.57	3002 47.09	32	NL35 265.00	1038 192.13
7½	4012 59.30	1011 52.64	7½' 49.59	33		1039 197.49
8	4013 63.30	1012 55.67	3003 52.89	34	NL06 290.00	1040 202.81
8½	4014 67.25	1013 58.64		35		1041 208.13
9	4015 71.20	1014 61.56	3004 58.48	36	NL33 302.00	1042 213.41
9½	4016 75.00	1015 64.42	9½' 60.98	37	NL66 307.00	
10	4017 86.00	1016 67.21	3005 63.85	38	NL73 312.00	
10½	4018 90.00	NL30 70.00		39	NL74 317.00	
11	4019 94.00	1017 72.59	3006 68.96	40	NL75 322.00	
11½	4020 98.50	NL21 75.38		41	NL60 327.00	
12	4021 103.00	1018 78.51	3007 74.58	42	NL61 332.00	
13	4022 107.00	1019 84.27	3008 80.06	43	NL64 337.00	
14	4023 114.00	1020 89.84	3009 85.35			
15	4024 121.00	1021 95.60	15' 90.35			
16	4025 126.00	1022 101.73	16' 95.35			
17	4026 133.00	1023 107.47				
18	4027 140.00	1024 113.23				
19	4028 147.50	1025 118.98				
20	4029 155.00	1026 124.74				
21	4030 164.50	1027 130.48				

Misc. Skid Comp.
Revised Price List

10-6-83

2	NL09	12.66	NL38	5.07	6502	11.85	1½	6537	7.00
2½	1072	15.83	6201	6.33	6503	13.20	2	6538	8.50
3	1073	18.99	6202	7.59	6504	14.43	2½	6539	10.25
3½	1074	22.16	6203	8.87	6505	14.80	3	6540	12.00
4	1075	25.33	6204	10.13	6506	17.03	3½	6541	14.00
4½	1076	28.49	6205	11.40	6507	19.28	4	6542	15.00
5	1077	31.67	6206	12.66	6508	21.53	4½	6543	16.50
5½	1078	34.82	6207	13.92			5	6544	18.00
6	1079	37.99	6208	15.20			5½	6545	19.00
6½	1080	41.15	6209	16.46			6	6546	23.00
7	1081	44.33	6210	17.73			6½	6547	24.50
7½	1082	46.30	6211	18.52			7	6548	26.00
8	1083	49.39	6212	19.75			7½	6549	27.50
8½	1084	52.48	6213	20.99			8	6550	29.00
9	1085	55.56	6214	22.23			8½	6551	30.00
9½	1086	58.66	6215	23.47			9	6552	31.00
10	1087	62.24	6216	24.89			9½	6553	33.00
							10	6554	35.00

NL07	10.00
6501	10.00

Standard Prices
Misc. Skid Comp.

10-6-83

Appendix J

Format A - Procurement of Wooden Skids

Format A - Procurement of Wooden Skids

ECONOMIC ANALYSIS PROGRAM - Format A

PROJECT: Skidding of IPE
ALTERNATIVE: Wood-profit
ECONOMIC LIFE: 25
RATE(F2): 0.1
DATE: 9-18-85

YR	NRC-COST	REC COST	TOTAL COST	DISCOUNT	DISCOUNTED COST
1		740935	740935	0.954	$706,721.23
2		740935	740935	0.867	$642,473.84
3		740935	740935	0.788	$584,067.13
4		740935	740935	0.717	$530,970.12
5		740935	740935	0.651	$482,700.11
6		740935	740935	0.592	$438,818.28
7		740935	740935	0.538	$398,925.71
8		740935	740935	0.489	$362,659.74
9		740935	740935	0.445	$329,690.67
10		740935	740935	0.405	$299,718.79
11		740935	740935	0.368	$272,471.63
12		740935	740935	0.334	$247,701.48
13		740935	740935	0.304	$225,183.16
14		740935	740935	0.276	$204,711.97
15		740935	740935	0.251	$186,101.79
16		740935	740935	0.228	$169,183.44
17		740935	740935	0.208	$153,803.13
18		740935	740935	0.189	$139,821.03
19		740935	740935	0.172	$127,110.02
20		740935	740935	0.156	$115,554.57
21		740935	740935	0.142	$105,049.61
22		740935	740935	0.129	$95,499.64
23		740935	740935	0.117	$86,817.86
24		740935	740935	0.107	$78,925.32
25		740935	740935	0.097	$71,750.30
26			0	0.000	$0.00
27			0	0.000	$0.00
28			0	0.000	$0.00
29			0	0.000	$0.00
30			0	0.000	$0.00
TOT	$0.00	**********	18,523,375.00	9.523683	$7,056,430.55

Total Discounted Cost: $7,056,430.55
Uniform Annual Cost (UAC): $740,935.00

Existing Assets Replaced (EAR)(Discounted).....: $2,284,375.00
UAC with EAR: $501,072.49

Terminal Value (T.V.)(Discounted): 0
UAC with T.V. and EAR:.....: $501,072.49

Appendix K

Format A - Equal Uniform Annual Costs (UAC)

Format A - Equal Uniform Annual Costs (UAC)

ECONOMIC ANALYSIS PROGRAM - Format A

PROJECT: Skidding of IPE RATE(F2): 0.1

ALTERNATIVE: Wood-63% profit DATE: 9-18-85

ECONOMIC LIFE: 25

YR	NRC-COST	REC COST	TOTAL COST	DISCOUNT	DISCOUNTED COST
1		984757	984757	0.954	$939,284.39
2		984757	984757	0.867	$853,894.90
3		984757	984757	0.788	$776,268.09
4		984757	984757	0.717	$705,698.26
5		984757	984757	0.651	$641,543.87
6		984757	984757	0.592	$583,221.70
7		984757	984757	0.538	$530,201.55
8		984757	984757	0.489	$482,001.41
9		984757	984757	0.445	$438,183.10
10		984757	984757	0.405	$398,348.27
11		984757	984757	0.368	$362,134.79
12		984757	984757	0.334	$329,213.45
13		984757	984757	0.304	$299,284.95
14		984757	984757	0.276	$272,077.23
15		984757	984757	0.251	$247,342.94
16		984757	984757	0.228	$224,857.21
17		984757	984757	0.208	$204,415.65
18		984757	984757	0.189	$185,832.41
19		984757	984757	0.172	$168,938.55
20		984757	984757	0.156	$153,580.50
21		984757	984757	0.142	$139,618.64
22		984757	984757	0.129	$126,926.04
23		984757	984757	0.117	$115,387.30
24		984757	984757	0.107	$104,897.55
25		984757	984757	0.097	$95,361.41
26			0	0.000	$0.00
27			0	0.000	$0.00
28			0	0.000	$0.00
29			0	0.000	$0.00
30			0	0.000	$0.00
TOT	$0.00	**********	$4,618,925.00	9.523683	$9,378,514.15

Total Discounted Cost: $9,378,514.15

Uniform Annual Cost (UAC): $984,757.00

Existing Assets Replaced (EAR)(Discounted).....: $2,284,375.00

UAC with EAR: $744,894.51

Terminal Value (T.V.)(Discounted): 0

UAC with T.V. and EAR:.....: $744,894.51

Appendix L

Format A - Average Costs

Format A - Average Costs

ECONOMIC ANALYSIS PROGRAM - Format A

PROJECT: Skidding of IPE RATE(F2): 0.1

ALTERNATIVE: Wood-Average Cost DATE: 9-18-85

ECONOMIC LIFE: 25

YR	NRC-COST	REC COST	TOTAL COST	DISCOUNT	DISCOUNTED COST
1		1127384	1127384	0.954	$1,075,325.37
2		1127384	1127384	0.867	$977,568.52
3		1127384	1127384	0.788	$888,698.65
4		1127384	1127384	0.717	$807,907.87
5		1127384	1127384	0.651	$734,461.70
6		1127384	1127384	0.592	$667,692.45
7		1127384	1127384	0.538	$606,993.14
8		1127384	1127384	0.489	$551,811.94
9		1127384	1127384	0.445	$501,647.22
10		1127384	1127384	0.405	$456,042.93
11		1127384	1127384	0.368	$414,584.48
12		1127384	1127384	0.334	$376,894.98
13		1127384	1127384	0.304	$342,631.80
14		1127384	1127384	0.276	$311,483.46
15		1127384	1127384	0.251	$283,166.78
16		1127384	1127384	0.228	$257,424.34
17		1127384	1127384	0.208	$234,022.13
18		1127384	1127384	0.189	$212,747.39
19		1127384	1127384	0.172	$193,406.72
20		1127384	1127384	0.156	$175,824.29
21		1127384	1127384	0.142	$159,840.26
22		1127384	1127384	0.129	$145,309.33
23		1127384	1127384	0.117	$132,099.39
24		1127384	1127384	0.107	$120,090.36
25		1127384	1127384	0.097	$109,173.05
26			0	0.000	$0.00
27			0	0.000	$0.00
28			0	0.000	$0.00
29			0	0.000	$0.00
30			0	0.000	$0.00
TOT	$0.00	**********	$28,184,600.00	9.523683	$10,736,848.58

Total Discounted Cost: $10,736,848.58

Uniform Annual Cost (UAC): $1,127,384.00

Existing Assets Replaced (EAR)(Discounted).....: $2,284,375.00

UAC with EAR: $887,521.52

Terminal Value (T.V.)(Discounted): 0

UAC with T.V. and EAR:.....: $387,521.52

Appendix M

Documentation for Material Costs

2 of 2

Aluminum Skid Mod/Repair @ 3,510 hours
@ 1744/person = 2.0126 persons

Production Machine Repairer
Equipment Repairer) @ WG 08

BASE	WG 08/step 4 = 21851 X 2.0 =	$ 43,702.
	43,702 + 27.3% = $55,633	55,633
		+ 3.5%
	First Period	$ 57,580
		+ 5.6%
	Second Period	$ 60,804
		+ 5.8%
	Third Period	$ 64,331
		+ 5.5%
	Fourth Period	$ 67,869
		+ 5.3%
	Fifth Period	$ 71,466
	Total Five Years	$322,050

Materials - estimate @ $2,000/yr.
Using same source of Supply Markup/%
GSA @17.26% + 21% = 345 + 21% = $418 ----
DoD 13.85% + 24.5% = 277 + 24.5% = 345 ---- $2141
Local 68.89% + 0% = 1378 + 0 = 1378 ----

	1	2	3	4	5	
Plus Inflation Factors @	4.5%	4.2%	3.9%	3.7%	3.7%	=
	2237	+2331	+2422	+2512	+2605	= 12,107

ALUM SKID BREAKOUT FROM DCSC TOTAL IPE BID

PERSONNEL: I reviewed the Management Study and 3510 hrs were identifed for the Aluminum Skid Opns. Using 2.0 personnel at the WG-08/4 level, and inflating for the five years. Total = $322,050

MATERIALS/SUPPLIES: I reviewed ~~ace~~ CLK cost estimate sheets: $2,000 estimate for replacement of nuts/bolts, etc. Other skid hardware was in good stock condition. $2,000 was in the operating supplies and was extended, using percent of source with appropriate mark-up then inflated for five years. Total ± $12,107

TOTAL PERSONNEL AND MATERIAL/SUPPLIES - five years = $334,157

This represents 1.34% of $24,946,258 total bid.

Worksheet attached.

NORMAN MARTELL
9 August 1985
(AV)850-2204
(COMM) 614-238-2204